MUNICIPAL JOURNAL AND ENGINEER

VOLUME XVIII NEW YORK, APRIL, 1905 No. 4

LAMP TESTING*

Useful Department Added to Electrical Engineering in Iowa State College—Growing Demand Met by Establishment of a Testing Bureau

By L. B. Spinney

THERE has been established in connection with the Electrical Engineering Department of the Iowa State College a laboratory for the testing of incandescent lamps.

It is a well-known fact that a very large part of the data upon which it is customary to rely for a knowledge of the behavior of the incandescent lamp under varying conditions of voltage and efficiency, has originated in the factory, and that comparatively few lamp tests of a general nature have been made in a disinterested way. Those who care to trouble themselves with investigations of the nature above referred to, are, in general, compelled to send their lamps to a great distance to some standardizing bureau or to provide themselves with the necessary apparatus for making the tests. The consequence is that very little work of this kind is done since either procedure is often times out of the question because of the expense involved.

The writer is convinced that a growing demand is being met by the establishment of a testing bureau at which for a reasonable outlay a reliable lamp test may be secured.

It would seem altogether absurd to argue the importance of lamp testing, for the every-day experience of the lamp user is constantly directing his attention to this question. For this reason such statements of fact as are given below in this connection are to be regarded rather as introductory to that which follows than in any other light.

Reed in his "American Meter Practice" referring to the importance of photometric tests of lamps, says: "The success which the electric light has attained is based primarily on its intrinsic merits, its convenience, cleanliness and adaptability, rendering it superior to any other commercial light, but not necessarily cheaper. Its march forward to the final limit of universal use depends then on two main underlying qualities; first, its superiority over other lights; and second, its ability to compete commercially with other light-giving sources. Almost every day brings forth some new form of light, which the enthusiastic inventor claims will render the electric light obsolete in a very short time. * * * The price of electricity has shown within the past few years a tendency to become less, as more economical methods of generation are utilized, but it is safe to say that no very radical departure in present prices will come about as long as the efficiency of the incandescent lamp remains at its present low figure. The lamp may be considered the keystone of the entire structure; it is the final link in the series of transformations of energy which take place between the coal-pile and the light, and on its economy (other conditions being favorable) depends the earning power of the central station."

The importance of lamp efficiency is thus strongly emphasized.

In planning the average electric light plant much attention is justly given to the efficiency of the boiler room installation because in this equipment even under best conditions but a low efficiency is obtained. It is also insisted upon that the electric machinery be of standard manufacture and efficient in every respect, although relatively speaking, even in the less satisfactory forms of apparatus of this character, a high efficiency is secured. On the other hand, the efficiency of the lamp used, a question the importance of which is pointed out above, often receives little or no attention. At first sight the lamp efficiency may appear of equal importance with that of the boiler or dynamo efficiency and no more so for the energy available in the lighting system must pass through each of these devices, and the efficiency of each part of the plant appears as a factor in the general result; but upon closer inspection it is evident that because its value is low at best the actual value of the lamp efficiency is of really

* Abstract of paper read before the Iowa Electrical Association.

greater importance than that of the other parts of the system in determining the efficiency of the plant as a whole.

This point being conceded the importance of photometric lamp tests is at once established for the only means of determining lamp efficiencies is by the use of the photometer. The efficiency of lamp, as in the case of any other device for

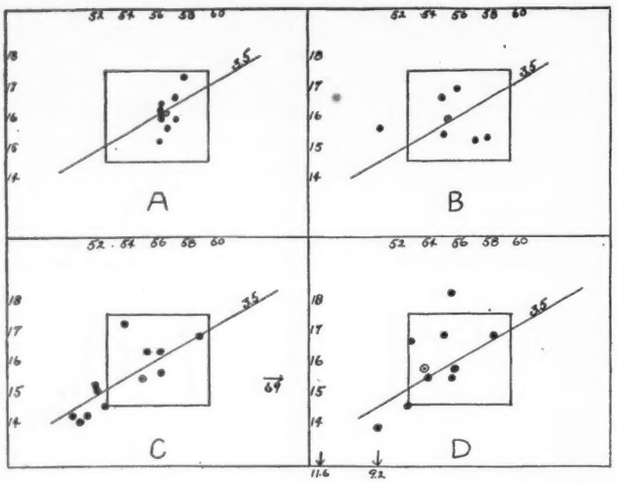

Fig. 1

the transformation of energy is given by the ratio of the useful output to the total input. The useful output in the form of light is measured in candle power. The input in the form of electric energy is measured in watts. The efficiency would therefore be logically expressed in candle power per watt. Custom has, however, established the use of the inverted efficiency and a lamp is commonly described as taking so many watts per candle power.

It cannot be said that high efficiency lamps should always be used. Indeed, it may be shown that under certain circumstances best practice would point to the use of lamps of low efficiency. In any given case there is always a number of things to be taken into account in the determination of that efficiency which is best adapted. It will be understood that in those cases in which the cost of power, for any reason, is excessive, much is to be gained by the use of high efficiency lamps in spite of the greater cost of renewals due to the shorter life of such lamps. On the other hand, for plants operated by water power in which increased load does not involve increased operating expense, it is conceivable that a lamp of lower efficiency would be desirable.

Mr. L. G. Van Ness considers that the most desirable efficiency is determined by the following considerations:

(1) The average regulation of the circuit.

(2) The generating costs that are strictly proportional to output.

(3) Investment per kilowatt capacity of station.

(4) The average consumption per lamp per year.

(5) The charge per kilowatt per hour to consumer.

It would be foreign to the purpose of this paper to enter upon a detailed discussion of this point. Suffice it to say that for each set of conditions there is one efficiency which is better adapted than any other. Having reached a conclusion in this matter it behooves the plant manager to make sure that lamps of the desired efficiency are placed in operation.

One does not need to make a very comprehensive series of lamp tests in order to convince himself that the various lamps on the market are widely different in their characteristics or that there is often an appreciable difference even in the lamps of the same manufacture. Of course, it goes without saying that it is impossible to manufacture lamps in large numbers that are exactly alike and a certain variation is to be looked for and accepted but this fact hardly makes the test for general averages less important or instructive nor does it in any wise warrant the manufacturer in relaxing his vigilance in the production of a lamp as constant in its properties as may within practical limits be secured.

It would seem that common business considerations would convince the station manager that he should have definite knowledge of the performance of his lamps, for it would be the height of folly to make a painstaking determination of the most suitable lamp efficiency and then fail to make sure that lamps of such efficiency were employed and this statement is to be taken not as referring to the large users of lamps alone; but to any and all upon whom the management of a light plant may fall.

Another consideration in this connection is the decreased efficiency with the life of the lamp. The practice, not at all uncommon in smaller plants, of leaving lamps in circuit until they are burned out, is of course to be condemned. Aside from the consideration of efficiency there is that of the annoyance and dissatisfaction to the customer which is always attendant upon the use of dim lamps. Alexander Dow, of the Detroit Edison Illuminating Company, states that ninety per cent. of the complaints of consumers can be traced to dim lamps. It is now very generally agreed that a lamp should be replaced when its candle power has fallen to eighty per cent. of its initial value. In order that lamps may not be kept in circuit beyond the limit of useful life it is necessary either to keep a record of all lamps as to date of renewals and the hours per day burned and rely upon a knowledge of

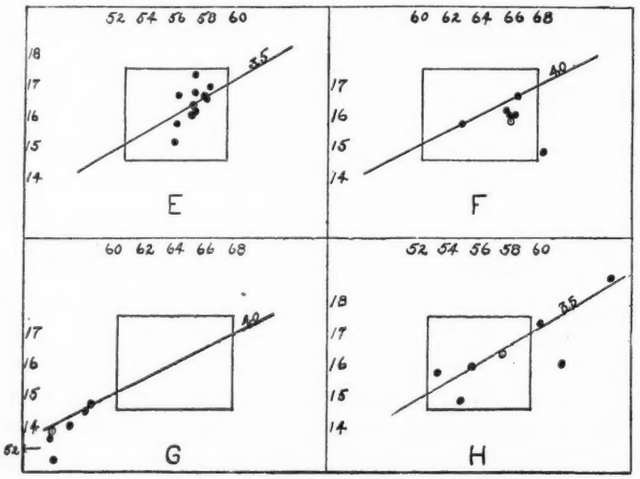

Fig. 2

the average behavior of the lamps used for determining the proper dates for renewals or to make photometric tests of all lamps from time to time rejecting those which have fallen in candle power below a certain value. Perhaps a better method than either of those given is a combination of the two. Mr. F. W. Wilcox, in a paper read before the National Electric Light Association in 1901, describes the methods employed by the United Illuminating Company, of New

Haven, Conn. This company makes four renewals per year. The old lamps are returned to the station, cleaned, and tested for candle power. Those testing above a certain value (14 or 15 C. P. for 16 C. P. lamps) are placed again in service. Those falling below this value are again sorted and those showing a certain per cent. of the initial candle power are kept as second-class lamps and placed in special service, such

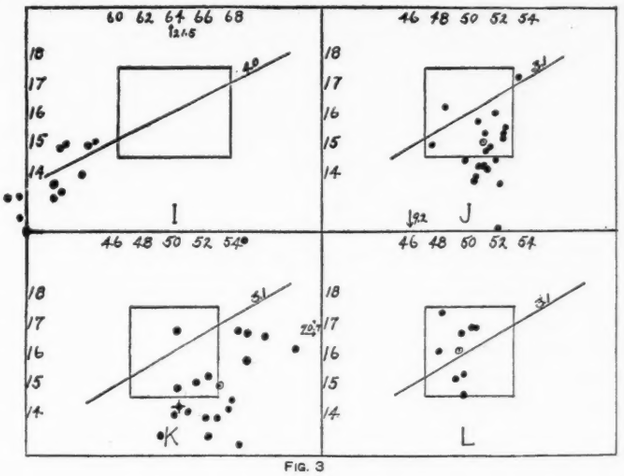

FIG. 3

as street illuminating. All others are at once rejected. Reed recommends a similar method and suggests that the second-class lamps be placed in service near the power house where the voltage, as a rule, is maintained at a higher value. Every consideration of good practice is thus seen to point to the importance of lamp testing, and it would seem necessary that every station manager should inform himself as to the average efficiency of his lamps.

The writer believes that every moderately sized plant should provide itself with some means for lamp testing and that such provisions could be made with profit in many of the smaller establishments. This does not mean that a standard phonometer fitted for refined measurements should be provided; but by some more or less inexpensive arrangement (there are various suitable devices) means should be secured for the rough testing or checking of returned lamps. By the combination of such tests, with occasional standardizing tests made at a testing bureau, it would be possible to secure a very definite knowledge of the behavior and condition of the lamps in service on any system at a cost which, far from being prohibitive, would in many cases be almost inconsiderable, and it may, with little hesitation, be said that in any case the better service resulting from such practice, the increased satisfaction of customers and the consequent increase of business will amply repay any expense incurred in this way.

The following diagrams give the results of tests made in the Electrical Engineering Department of the Iowa State College on sixteen different makes of lamps, and will serve to illustrate the wide variation which exists in modern incandescent lamps.

These diagrams, commonly known as "target" or "shot-gun" diagrams, are drawn as follows: The candle power of a lamp is laid off vertically and the total power (in watts) taken by the lamp is laid off horizontally. The results of an initial candle power and wattage test on a lamp are therefore given by a single dot in the diagram. For example, in Fig. 1 A, the highest point represents a lamp of 17.3 candle power taking a total of 57.8 watts. The sloping line is the line of 3.5 watts per candle, and gives the rating of the lamps tested. The rectangular "target" has a height of 3 candle power (1½ candle power above and below the rated candle power of the lamp), and a width of 12 per cent. (6 per cent. above and 6 per cent. below) of the total rated watts. The circle with dot in center gives the average result for all lamps represented in the diagram.

The most satisfactory tests obtained are those represented in diagram A, Fig. 1, and diagram E, Fig. 2, in both of which all lamps fall within the prescribed limits. The least satisfactory are those represented in diagram G, Fig. 2, and diagram I, Fig. 3, in neither of which does a single point fall within the target. It will be noted that in neither of these groups are the lamps far from the rated watts per candle power.

Diagram K gives the results of a test of 23 lamps rated by the manufacturer as 16 candle power 3.1 watt lamps. The average candle power of this group is 14.9 and the watts per candle power 3.57. The group as a whole lies outside the limits; but four dots falling within the target.

Diagrams L and O, Figs. 3 and 4, are instructive, the latter especially so, as showing the insufficiency of a wattmeter test. It will be seen from these diagrams that a group of lamps may not only appear to much better advantage in a simple wattmeter test than in a test for candle power; but that a wattmeter test by itself is altogether inadequate in determining how carefully a lamp has been rated. The lamps represented in diagram O, Fig. 4, all fall within the limits as to total watts consumed while in candle power, two out of a total of six are entirely outside of the prescribed limits.

The tests represented by the diagrams here shown while not as extensive as could be wished, are yet of service in showing the need of making lamp tests. Some of the lamps

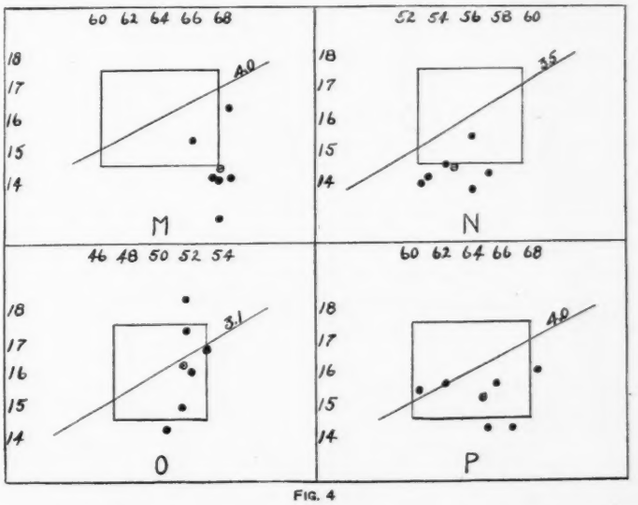

FIG. 4

from which these results were obtained were purchased by the Department of Electrical Engineering from the manufacturer or his agents direct. The others were sent to the Department from central stations in various parts of the State. The lamps tested, therefore, may be taken as a fair average of the lamps which one may expect to find on the market.

THE NEW PARIS

Building Regulations Regarding the Height and Projection of Buildings in the French Capital—Interests of Architectural Beauty Guarded

By Paul Strauss

The Commission on Sanitary Regulations, adopting a practice which is universal in Europe, wished to make a smoke-shaft obligatory, and to fix the minimum opening for lighting and ventilation.

It seemed to the Commission that it was necessary to fix a minimum area for each room in order that in relatively high stories they should not be built too narrow. Therefore, it has been decided that on the ground floor and in other stories, with the exception of the top of the house, each living room

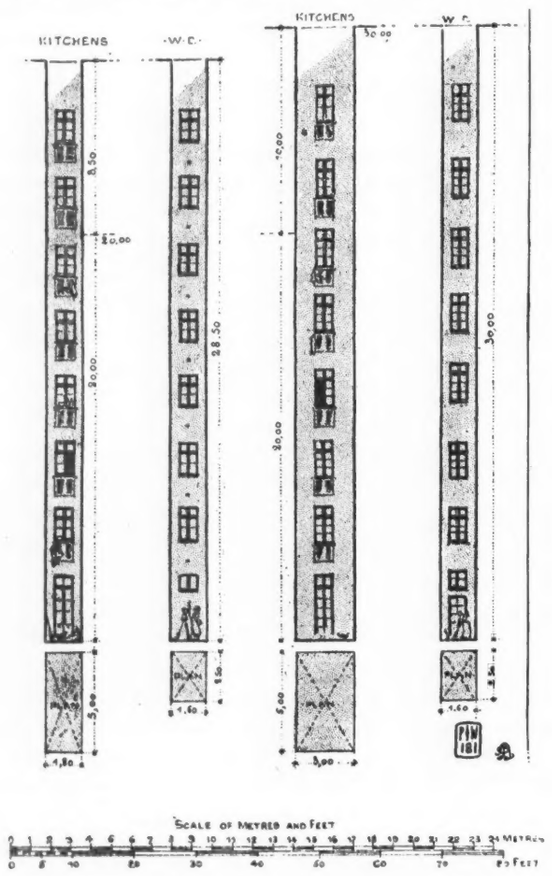

Fig. 6.

Sections of small courts giving light and air to kitchens and w.c.'s. These sections show the minimum dimensions in conjunction with the maximum of height.

used day and night must have a minimum area of 9 sq. metres (say 97 sq. ft.). Each room must have an opening into a chimney and must be lighted and ventilated from the street or court-yard by one or more windows, the total dimensions of which must be at least equal to one-fifth of the area of the floor of the room.

An exception is made in the case of the concierge's lodge, which must have an area not less than 12 sq. metres (about 130 sq. ft.).

On the top floor each living room must have a minimum floor space of 8 sq. metres (say 86 sq. ft.). The window must at least equal in area one-eighth of the floor space.

In the case of rooms with sloping ceilings the space will be measured half way up the containing walls. All sloping roofs must be so arranged as to protect the dwelling from exterior variations of temperature.

The care taken by the city of Paris to remedy the well-known unsanitary condition of the lodges of the concierges will be noted.

The following is a comparative table of the minimum areas of living-rooms calculated from the foregoing regulations:—

A special clause enacts that staircase wells must be lighted and ventilated directly in every part.

Borrowed lights cannot in any case be considered as ventilating apertures.

In every clause of the coming sanitary regulations there is an evident determination to complete or re-establish the stipulations which the decree of 1902 would have contained if the Conseil d'Etat had not thought it advisable to wait until the statute concerning the public health was in force. It is not surprising therefore that some of the clauses of the decree of 1902 have been revised and that others have been extended.

To ensure inhabited houses from the danger of damp foundations the impermeability of the soil and of the walls—round the inhabited basement rooms, or, when the ground floor is built over cellars or on the ground, at the corresponding level—is rigorously enforced. The walls must be preserved from moisture by the application of a coat of some damp-proof composition.

III.—It was necessary for judicial reasons to leave to the sanitary regulations the codifying of certain stipulations highly important in building construction and properly concerning public order.

The most important concerns the removal from rooms of the products of combustion. It is almost superfluous to insist on the dangers to the inhabitants of a house of badly-built chimneys and defective flues. It is the duty of the sanitary authority to be assured that the arrangement of the chimneys or flues guards against the possibility of accidents, that the flues have no flaws by which they can admit combustion products into the house, and that the chimney-stack is tall enough. The height of the chimneys is fixed at a minimum of 40 centimetres (16 ins.) above the highest part of the roof.

The fireplaces are to be furnished with inlets for the admission of the external air. The minimum section of these must be .01 sq. metre (15½ sq. ins.).

The heating apparatus, whether fireplace, stove or other appliance, must be so constructed and arranged that it will admit into the rooms neither smoke nor gas dangerous to the health of the inhabitants.

The air supply for house warming appliances must be taken only from the street or court-yard.

The regulations explicitly insist upon a means of escape for the products of combustion where smokeless fuel (as, for instance, coke) is burnt, or where gas or liquid fuel is burnt, and this obligatory stove-pipe or chimney must have a minimum section of .04 sq. metre (62 sq. ins.).

Moreover, living-rooms used day and night and provided with a heating apparatus, and rooms in general containing stoves, must be properly ventilated. To leave builders more latitude, and in order to avoid favoritism, no particular system is specified.

Minute instructions have been drawn up to ensure that cooking ranges, fixed or movable, shall have an escape-pipe with or without a hood.

Although it is to the interest of builders to neglect none of these precautions, the Préfet de la Seine has done his duty in recording them in an official document and making them obligatory. Frequent accidents have demonstrated the absolute necessity of including these clauses in the regulations.

In order that a house should be habitable in accordance with the laws of health it must conform to the formal conditions with regard to its service of potable water, to the arrangements for removing rain water, and to the disposal of the household refuse.

The clauses relative to these matters do not require comment; it will be sufficient to quote or to analyze them.

Henceforth, if the projected sanitary regulations undergo no modification, every house inhabited either by day or night must be connected with the water main by a system of pipes capable of carrying a proper service to each story, this last clause being new as to Paris.

Every tap must be properly mounted over a sink carrying away the waste water into the sewer. No tap for drinking water must be placed in a privy.

Proper water-tight gutters and down-spouts must be provided on the houses, and the court-yards must be laid with an impermeable and non-putrescible material.

The *"tout à l'egout"* system (everything to the sewer)—that is to say, the direct discharge of night-soil, etc., to the sewer—is now the legal maxim of Paris. The sanitary regulation will give the Préfet the power of enforcing this very wholesome arrangement in the strictest manner. As a general principle all apartments consisting of three living rooms (not counting the kitchen) and upwards must contain a privy and sink. As regards living rooms let singly or in pairs, the provision of one privy to each five rooms will be enforced, and there must be a sink to each ten living rooms. The servants' garrets, apart from the apartments, are not included in this category. Henceforth the Préfet may prescribe that all pans in the privies must be so arranged that the drain-pipe is hermetically and permanently sealed from communication with the closet. The hydraulic syphon, or water seal—which in the present state of sanitary engineering is evidently the device best calculated to ensure the desired result—is not mentioned, therefore this stipulation will still for a long time be called into question and opposed.

The pan, every time it is emptied, must receive sufficient water to carry away its contents and so cleanse it thoroughly.

Water-closets, manipulated by pulling a chain and furnishing a sufficient force of water, are allowed on the following conditions:—

	Minimum area of habitable rooms.	Cubic Minimum.	Windows.	
			Apertures in proportion to the area of living-rooms.	Minimum Area.
Basements	12 m. (130 sq. ft.) superficial	31 m. 20 c. (1102 cubic ft.)	$\frac{1}{10}$	1 m. 20 c. (13 sq. ft.)
Ground-floor and storeys ...	9 m. (97 sq. ft.)	24 m. 80 c. (876 cubic ft.)	$\frac{1}{9}$	1 m. 80 c. (19$\frac{1}{3}$ sq. ft.)
Porter's lodge	12 m. (130 sq. ft.)	31 m. 20 c. (1102 cubic ft.)	$\frac{1}{9}$	2 sq. m. 40 c. (26 sq. ft.)
		32 m. 60 c. (1151 cubic ft.)	$\frac{1}{9}$	
Top storey	8 m. (86 sq. ft.)	20 m. 80 c. (735 cubic ft.)	$\frac{1}{8}$	1 m. (10$\frac{3}{4}$ sq. ft.)

1. The water-supply must be obtained either from an automatic service-box or directly from the house service.

2. Special facilities must be provided for drain flushing, as compared with those for ordinary purposes.

Until now the construction of urinals in the interior of houses was not safeguarded by regulations. These must be built of impermeable and non-putrescible materials, must be furnished with a sufficient force of water and disinfected thoroughly by one means or another, and before their connection with the soil-pipe must be permanently and hermetically water sealed.

The water seal will be similarly enforced in the case of all sinks of every description in the house, court-yard, stable or carriage-house.

The drain pipes from the privies must be entirely distinct from the drain pipes removing the rain water or house waters; they will run into a common soil-pipe.

In order to prevent backflow of sewage into the basement and cellars, the kitchen sinks and also those of the closets and urinals must be on a higher level than the street towards which the waste waters are run off. This is the rule; but in cases where circumstances will not allow the arrangement to be carried out the house-owner must take the necessary precautions to prevent any possible backflow of sewage.

The diameter of the closet-pipes, calculated according to the discharge, must not be less than 0.10 metre (4 ins.). They must be water-tight and must be carried up for the purposes of ventilation at least 1 metre (say 40 ins.) above the highest part of the building.

The rain and house-water pipes must be, if possible, carried up above the roof for the sake of ventilation. The only allowable exception will be in the case of drain pipes dealing solely with rain water. These alone may open directly into the gutters.

The diameter of the rain water-pipe may be reduced to 0.05 metre (2 ins.).

The drain pipe from the house, composed of straight pieces discharging from the house must have a diameter calculated according to the work it has to do, but its minimum diameter where it discharges into the public sewer must not be less than 0.12 metre (4¾ ins.).

The drain pipe from the house, composed of straight pieces joined together by curves as free from angles as possible, must be laid so as to have a uniform downward slope of at least 0.03 per metre (1 in 33). In the exceptional cases where it is impossible to carry out this regulation the Administration will have a right to insist upon the addition of flushing tanks or other means of carrying off the sewage.

The drain pipes must be of strong impermeable and non-putresible material. They must have a smooth surface, and must be connected by water-tight joints. These joints must not be hidden by brickwork or masonry, and where possible they must be accessible. In this way the pipes may be kept in working order at a number of easily accessible places where movable but absolutely hermetically-sealed joints will be provided.

IV.—It may truly be said that these new regulations will constitute a new code of building construction in Paris. This code is as complete as possible, and has taken the habits of the people thoroughly into account. If it be not perfect, at least it has taken the necessities of hygiene strictly into consideration.

Since 1852 every builder in Paris has been obliged to obtain permission from the Administration before erecting a house. He has been obliged to furnish plans and sections of projected buildings, and to carry out all the conditions imposed upon him in the interests of public security and health.

The statute and the sanitary regulations merely confirm this obligation and at the same time rule the builder with a firmer hand. As a matter of fact the "permit to build" will state that, in the project submitted to the Administration, the sanitary regulations are observed. Thus in the matter of the drainage of the house there are new and supplementary guarantees of the public health, and new buildings will in no case be allowed to depart from the regulations without very exceptional authorization.

The decree of 1852 instituted the decennial cleansing of the house fronts. The new regulations extend this obligatory wash to the interior of the house, to the façades in the court-yards and back-yards, and to all passages, vestibules and closets in common use.

This extension of the regulation is very necessary. Very handsome buildings from the point of view of the exterior are in a deplorable state within. The tenants, especially in thickly populated districts, have no resource against their landlord and do not complain except in extreme cases. In case of complaint the Commission on Unwholesome Dwellings takes action.

It is useless to insist upon the necessity of a periodical cleansing of the interiors of buildings. The new regulation has attempted as far as possible to remedy the notoriously filthy condition of far too many houses in Paris as seen from the back or on intimate acquaintance with the interior.

It seemed unnecessary to recommend that all stove-pipes and ventilation tubes should be air-tight and that all water-pipes should be water-tight; the police regulations have always enforced this. Experience shows, however, that it is impossible to repeat such recommendations too often, in spite of their simplicity, for too many Parisian landlords and agents cannot be depended upon to do their obvious duty spontaneously.

Moreover, it is not merely private persons who set the example of negligence and thoughtlessness. The public administrators themselves too often show that they are careless of the laws of health. Latterly, since the commencement of the campaign against consumption, the servants of the public have been awakened to a sense of their responsibility. An interesting clause of the sanitary regulations, therefore, extends them to public buildings, schools, hospitals, casual wards, barracks and public offices.

Architects and lovers of the picturesque need not be alarmed, since the Préfet de la Seine has it always in his power to make exceptions to the rule. The historical monuments will not be subjected to a treatment which might have a harmful effect upon their appearance. In a general manner, however, all buildings will be subject in their construction and in their upkeep to the common regulations. Special clauses where necessary will define the requirements in exceptional cases.

The Préfet de la Seine will have the right—apart from powers conferred on the Préfet de Police—to pay visits and hold enquiries in order to ascertain whether or not the sanitary regulations have been carried out.

The new code of building construction in Paris is, the writer has endeavored to show, highly important. It contains no excessive stipulations; it takes account of facts and of the manners of the people. It has been successfully inspired by the examples of foreign cities. There is nothing worrying in its regulations; they simply reduce to a minimum the requirements of the health of cities. Such as it is, with its inevitable imperfections, it is calculated to safeguard the health of the inhabitants of Paris. It is a meritorious effort to advance the well-being and comfort of the public, and realizes a praiseworthy attempt to make Paris a sanitary city. Time will show whether it needs revision here and there, but everything leads one to hope that under it the Parisians will be better protected than in the past against avoidable diseases, and will see their city gradually improve in salubrity and beauty.

(THE END)

PORTLAND CEMENT*

Its Uses in Engineering Constructions—Changes of Volume by Variations in Temperature—Continued

By E. Kuichling, C. E.†

In the two preceding numbers of THE MUNICIPAL JOURNAL AND ENGINEER, reference was made to the changes of volume of Portland cement and mortar by hardening and variations in degree of moisture, and we now come to the subject of changes of volume due to variations in temperature.

CHANGES OF VOLUME BY VARIATION IN TEMPERATURE

The changes of length of indurated cement, mortar and concrete by variations of temperature, are so intimately associated with those of natural stones and other building materials, that it becomes proper to consider them collectively instead of limiting the scope of our investigation to the former. It has long been known that the joints between the coping stones of masonry structures have a tendency to open in winter and close in summer; and the appearance in the cold season of vertical cracks or fissures in exposed walls of considerable length, coupled with their disappearance in the warm season, led to the supposition that these phenomena were caused mainly by variations of the temperature of the atmosphere. Experiments in this direction with a number of materials were accordingly made many years ago, but the effect of the absorption of moisture does not seem to have been clearly recognized until within the past twenty-five years; hence the results of most of the earlier measurements must be regarded as subject to some correction.

In 1830-1, Colonel Totten, of the U. S. Engineers, caused careful observations of the elongation by rise of temperature to be made on samples of granite, limestone and sandstone at Fort Adams, R. I., the results being reported by Lieut. William H. C. Bartlett, in *Am. Jour. of Science and Arts* for 1832, Vol. 22, p. 136. The three specimens were each about 8 feet long by 11 inches square in section, cut respectively from a fine-grained granite boulder found at the head of Buzzard's Bay, a block of white, fine-grained and crystalline limestone, quarried near Ossining, N. Y., and a block of coarse-grained brown sandstone, quarried near Chatham, Conn. The lengths of the specimens at different atmospheric temperatures from August 18, 1830, to June 2, 1831, were measured by means of a rod of white pine, provided at each end with a copper leg or hook, to reach the axis of the block, and a graduated, slender wedge, whereby minute differences of length could be detected with high precision.

The fixed length of the rod between the hooks was corrected for variation by temperature at each observation by using Kater's and Struve's coefficient for the linear expansion of deal wood per degree F., viz: 0.00000255, along with the coefficient 0.00000944 for copper; and the temperature of the stone was ascertained by placing a thermometer in a deep groove, and keeping it therein under cover for a proper length of time. It may also be inferred that the stones were kept under cover in an open shed, as no reference is made to the absorption of moisture. These measurements yielded the following coefficients of linear expansion per unit of length and 1° F:—granite 0.000004825; limestone, 0.000005668; sandstone, 0.000009532.

In 1836, Prof. Alex. J. Adie, C. E., published in *Trans. Roy. Soc. of Edinburgh,* vol. 13, p. 366, the results of his measurements of expansion of various building materials by rise of temperature. These experiments were made with great care on specimens about 24 inches long, and from 1 inch to 0.5 inch square in section, placed in an apparatus wherein the bars could be heated by steam or cooled by ice to temperatures varying from about 33° to 208° F., and the changes of length observed with a suitable microscope. The values of the coefficients of expansion by heat per unit of length and 1° F. thus obtained, have been widely copied in many standard text and reference books, and are given in the following table, taken directly from the original publication:—

ADIE'S COEFFICIENTS OF EXPANSION BY HEAT, PER UNIT OF LENGTH AND 1° F.

1.	Roman cement, hardened and dry	0.00000750
2.	Sicilian white marble, 1st exp't while moist	0.00000780
	" " " mean of 3 exp'ts when dry	0.00000613
3.	Carrara marble, 1st exp't while moist	0.00000662
	" " mean of 2 exp'ts when dry	0.00000363
4.	Red granite, Peterhead, 1st exp't while moist	0.00000532
	" " " mean of 2 exp't when dry	0.00000498
5.	Grey " Aberdeen, " " " "	0.00000438
6.	*Arboath pavement " 4 " "	0.00000499
7.	†Caithness " " 3 " "	0.00000497
8.	‡Greenstone, Ratho, " " " "	0.00000449
9.	Slate, Penrhyn, Wales, " " " "	0.00000576
10.	Sandstone, Craigleith, " 4 " "	0.00000652
11.	Black marble, Galway, Ire. " 3 " "	0.00000247
12.	" " (softer) " 1 " "	0.00000266
13.	Best stock brick, " 2 " "	0.00000306
14.	Firebrick, " 2 " "	0.00000274
15.	Bowl of Dutch tobacco pipe, " 3 " "	0.00000254
16.	Rod of Wedgewood ware, " 2 " "	0.00000251
17.	Cast iron rod, planed to ½" square from casting 2" square " 2 "	0.00000637
18.	Cast iron rod, rough casting ½" square " 2 "	0.00000612

Notes by present writer. * The word "pavement" here denotes large flat stones or flags for sidewalks, etc. The Arbroath flagstones are tough, argillaceous sandstones, somewhat bituminous, and contain a slight admixture of mica and lime; they belong in the lower Devonian formation, and are somewhat softer than the Caithness flags.

† Caithness flagging is similar to the preceding, but considerably harder, and belongs in the middle Old Red Sandstone formation.

‡ Greenstone is a variety of eruptive or trap rock, containing feldspar and hornblende.

Concerning these materials, Adie states that the Roman cement was mixed neat, with the least possible quantity of water to secure plasticity, by thoroughly working the mass together and adding dry cement from time to time; and after the mass had set sufficiently in a mold of Bristol board, it

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† *Engineering Editor,* MUNICIPAL JOURNAL AND ENGINEER.

was allowed to harden for two weeks under water. When first placed in the apparatus for experiment, the rod still contained some moisture, and in this condition it expanded more than after it had become dry by repeated heating; but the rate of expansion is not given. In the case of the white marbles, the heating caused a permanent increase of length. It is also worthy of notice that the specific gravities of the Sicilian white marble and the black marble from Galway were nearly the same, being respectively 2.7127 and 2.7093, while the coefficient of expansion of the former is about three times greater than that of the latter. The effect of moisture on the rate of expansion is plainly indicated in these experiments, but no further investigation thereof was made.

Another series of experiments made by Bouniceau, in connection with the appearance in winter of several small cracks in a brick quay wall built in the preceding summer at Havre, France, is reported in *Annales des Ponts et Chaussées* for 1863, p. 178. The test specimens were of various composition, ranging in length from 1.69 to 2.40 meters (5.53 to 7.87 feet), and about 0.2 meter (8 inches) square in section. They were placed horizontally on large friction rollers at the bottom of an iron trough, which was set in brick work over a fire and filled with fresh water, whose temperature was gradually raised from about 10° to 95° C. (50° to 203° F.). Short studs fitted centrally into the ends of each specimen abutted against the lower ends of the two vertical levers, each of which carried a small telescope at its upper end for magnifying the movement on a graduated scale, and all parts of the apparatus above the top of the trough were protected as much as possible from radiating heat.

The specimens were thus tested for expansion by rise of temperature while immersed in water, but unfortunately no mention is made of any change of dimension by absorption of moisture, nor is the duration of the immersion previous to raising the temperature of the water given. It may, however, be inferred from the description that the specimens remained in the bath at least several hours, as only one experiment was made on any day, and the series extended over a period of three months. The results given in the paper are the averages of two experiments in each case, and are reproduced in the following table, along with the values corresponding to 1° F.:—

Bouniceau's Coefficients of Expansion by Heat, per Unit of Length and 1° C., also per 1° F.

	Materials.	Coefficient for 1° C.	Coefficient for 1° F.
1.	Portland cement, neat and hardened under water	0.0000107	0.00000595
2.	" " mortar, 1 part cement to 2 parts silicious sand, as used for hydraulic work	0.0000118	0.00000656
3.	Concrete, composed of mortar as in No. 2 and silicious pebbles, proportion not given	0.0000143	0.00000794
4.	Brickwork made of mortar as in No. 2, and sandy bricks from Havre and Honfleur, placed sidewise	0.0000089	0.00000494
5.	Same brickwork, but bricks placed lengthwise	0.0000046	0.00000256
6.	Dressed limestone, from Ranville	0.0000075	0.00000417
7.	" " " Maladrerie, near Caen	0.0000089	0.0000049+
8.	" granite, " Diélette	0.0000079	0.00000439
9.	" marble, source not stated	0.0000054	0.00000300
10.	Plaster of Paris, cast in mold	0.0000166	0.00000622

Bouniceau also applies the coefficient of expansion obtained for concrete to the case of a straight wall built of this material, 1,000 meters long, between immovable abutments and undergoing a change of temperature of 30° C. The resulting contraction should be $1{,}000 \times 30 \times 0.0000143 = 0.43$ meter (1.41 feet); and if the cracks were then filled with hard cement, the wall would tend to lengthen 0.43 meter on returing to its original temperature, whereby it would be bent 14 to 15 meters from its original straight alignment. Such deflections, however, do not occur, because in practice concrete walls are not truly monolithic, but consist of a relatively large quantity of stony material of small size united imperfectly by the cement, nor are the cracks when once formed usually filled up solidly. The material may also undergo an appreciable compression in its tendency to expand, in case that the fissures become filled with dust or other detritus in the course of time.

As it is demonstrated that changes of temperature tend to produce appreciable changes of length in masonry structures, it is possible that to this cause may be attributed the bulging and failure of certain long retaining and reservoir walls in the warm season. Bouniceau also refers to a certain other reservoir wall which was constructed during warm weather, and became fissured and leaky by contraction in the winter; in the following spring, however, the cracks closed by expansion and the leakage stopped. He likewise calls attention to the considerable differences in the rates of expansion of the different materials cited, remarking that the expansion of concrete is much greater than that of brickwork, and that it is greatest in plaster of Paris and least in marble.

The foregoing experiments of Bouniceau have been criticized by an experienced German engineer, Prof. L. Debo, in a pamphlet published in 1897, and as the points involved are of interest, an abstract thereof is here presented. The tests appear to have been made somewhat hurriedly, without giving the immersed specimens sufficient time to acquire the observed temperature of the water throughout their entire mass, as heat is transmitted very slowly through such materials. In all such cases, the temperature of the specimen itself, as well as that of the water, should be noted carefully at the beginning and end of every experiment, so that the observed change of length may be corrected for any existing difference in the temperatures of the water and the material. It is therefore probable that the given values of the coefficients of expansion are somewhat too large. The results are also vitiated in some degree by the effect of wetting the materials, and as the rates of absorption are not given, we cannot determine the proportions of the total elongation that are due respectively to swelling by absorption of moisture and to rise of temperature. Furthermore, slight permanent changes of length appear to be produced both by long soaking in water and by raising the temperature somewhat rapidly. Again, as masonry is not always submerged, it is desirable to know the coefficients for perfectly dry materials, as well as when having different degrees of moisture; and great care is needed in completely drying the specimens without exposing them to an excessive temperature. Finally, he considers that the great difference given in Bouniceau's table for brickwork with the bricks laid sidewise and lengthwise, is due either to some error of observation or to a marked

difference in the quality of the bricks in the two specimens. In support of his criticisms, Debo cites the experiments of Schumann on the swelling of various stones by absorption of moisture, which have already been considered in the foregoing, and certain other experiments by Meier, mentioned by Büsing and Schumann on p. 79 of the first edition of their work on "Portland Cement," Berlin, 1892. According to the latter, the coefficient of expansion of both neat Portland cement and mortars made with from 2 to 6 parts of sand, by raising the temperature from 23° to 77° F., is 0.00000678 per unit of length and 1° F., whereas according to Bouniceau's experiments the same coefficient for concrete is 0.00000794. He also states that the sandstone coping of a brick garden wall 75.46 feet in length had elongated only 0.276-inch from all causes in the course of 20 years, while if the elongation were to be computed from Adie's coefficient for sandstone (0.00000652) for a rise of 50° F., in combination with only one-third of Schumann's average coefficient of expansion of sandstone by absorption of moisture after two weeks' immersion (0.065 per cent.), we would obtain 0.295 + 0.196 = 0,455 inch, or about two-thirds more than the measured elongation.

Reference is also made by Debo to the observations of 15 vertical cracks which developed in the winter of 1886-7 in a long dock wall at Bremen, as reported in *Centralblatt der Bauverwaltung* for 1888, p. 94, by Chief Engineer Franzius. This wall is 6,562 feet long, 15.49 feet thick at bottom, 11.98 feet thick at top, and 23.95 feet high; it rests on a strong foundation of piles, is faced on both sides with brickwork laid in Portland cement mortar, and has an intermediate concrete core or filling 7.22 feet thick. A brick-lined subway, 3.61 feet wide and 4.27 feet high, for the reception of pipes and electric cables, is constructed in the upper portion. Most of the cracks appeared in the southern portion of the wall, which was built in warm weather. On February 1, 1887, when the temperature was 28° F., a certain crack which extended through the entire height and thickness of the wall, was 1.00 millimeter wide; about two weeks later, when the temperature had fallen to 19° F., it became 3.75 millimeters wide; on April 29 following, after the temperature had become 46° F., it was fully closed; but during the next winter it reopened, and was 3.50 millimeters wide on February 1, 1888. Up to this time there had been no settlement of foundation, nor had the wall in the vicinity of the crack been backed with earth. The other cracks behaved in a similar manner, except that in the places where the backfilling with earth had been completed, they did not reopen as much as before.

Unfortunately the distances between the cracks were not measured, but in order to derive a coefficient of expantion by temperature of brickwork laid in cement mortar from the above data, Debo assumes that they occurred at equal intervals of about 410 feet, and that between February 16 and April 29, 1887, when the temperature of the air had risen from 19° to 46° F., the difference between the mean temperatures of the masonry was probably not more than 12° F., or somewhat less than half the difference between the said two atmospheric temperatures. On this basis, the given expansion of 3.75 millimeters (0.148 inch) yields a coefficient = 0.00000250 for brickwork per unit of length and 1° F., whereas according to Bouniceau's experiments with bricks placed sidewise, as done to secure proper bonding, it is 0.00000494. In view of these discrepancies, Debo considers that more accurate experiments are needed to establish the true rate of expansion of building materials.

Keller's Experiments

The behavior of Portland cement and various mortars was also closely studied in 1893 by Professor Keller, of Carlsruhe, the results being given in *Thonindustrie Zeitung* for 1894, p. 469. The test specimens were prisms 300 mm. (11.81 inches) long by 70 mm. (2.67 inches) square in section, made of a certain brand of commercial Portland cement, as already described on p. 122, used both neat and mixed with from 1 to 8 parts of a mixture of clean river sand and pebbles in equal proportions. The largest pebbles had a maximum diameter of 20 mm. (0.79 inch). After their fabrication, the prisms were kept 24 hours in air, and then under water for some weeks, whereupon they were thoroughly dried in an oven and allowed to become cool. Their length was then carefully measured with an apparatus reading to 1/200 mm., and again after their temperature had been raised. Twenty-four measurements were made of each pair of the six prisms at different temperatures ranging from — 16° to + 72° C. (3° to 162° F.), and it was found that an exposure of each specimen for at least 24 hours to each uniform temperature was necessary in order to establish equilibrium. The condition of the prisms with respect to dryness was kept practically the same by the repeated heating and cooling operations, as determined by observing their weights; and the slight quantity of hygroscopic moisture which they absorbed unavoidably when kept for days in cold air, had no appreciable effect on their length. The resulting average coefficients of expansion of the dry prisms were as follows:—

Keller's Coefficients of Expansion of Portland Cement and Mortars by Heat, per Unit of Length and 1° C., also per 1° F.

Series Number	I.	II.	III.	IV.	V.	VI.
Composition	Neat Cement	1c+1s&g	1c+2s&g	1c+4s&g	1c+6s&g	1c+8s&g
Coefficient per 1° C.	0.0000126	0.0000110	0.0000101	0.0000104	0.0000092	0.0000095
Coefficient per 1° F.	0.00000700	0.00000611	0.00000561	0.00000578	0.00000511	0.00000528

The foregoing table indicates that there is a distinct relation between the coefficient of expansion and the composition of the specimen, and that the coefficient diminishes in proportion as the admixture of sand and gravel increases; also that when such admixture exceeds six times the volume of cement, the coefficient increases slightly, apparently being influenced by the character and size of the sand and pebbles. The latter phenomenon is likewise indicated by Bouniceau's experiments with wetted prisms of mortar and concrete, but it will be observed that his coefficients are much greater than those given above, thus confirming the doubts as to their accuracy expressed by Debo.

Experiments at Watertown Arsenal

The expansion of various stones and bricks by rise of temperature was also determined experimentally at the Watertown Arsenal in 1890 and 1894-6. The method adopted was the same as Bouniceau's, viz: measuring with

much precision the lengths of the specimen after immersion in water baths of different temperatures varying from 33° to 200° F., but the stone test pieces were much smaller, being generally blocks about 24 inches long, 6 inches wide and 4 inches thick. It was observed that in most cases the saturated samples did not quite regain their original length when first measured in a dry state in air, as previously stated on p. 71, and also that they showed a slight permanent swelling after passing from cold to hot water and back again. A few dry samples were similarly tested by placing them in sealed cases to protect them from contact with the water, and a small permanent elongation likewise ensued. The expansion of building bricks was measured in a length of 6 inches, and the effect of freezing them while saturated with water after one week's immersion was also noted, the result being a temporary elongation in all cases, a slight permanent elongation in 12 cases, a much smaller permanent contraction in 5 cases, and no change in 1 case. A general summary of these observations relating to permanent set, caused in natural stones by passing from the cold to the hot bath and back, and in bricks by freezing them in a saturated condition, is given in the following table:—

Permanent Elongation or Set, in Per Cent. of Length, caused in Various Stones by Rise of Temperature in Water from 33° to 200° F., and in Building Bricks by Frost. Watertown Arsenal Experiments.

Materials.	Per Cent. of Elongation. Average.	Maximum.	Minimum.
11 Varieties of Granite, from several States.	0.0210	0.0355	0.0095
7 " Marble, " .	0.0475	0.0980	0.0145
8 " Limestone " .	0.0350	0.0595	0.0120
12 " Sandstone, " .	0.0235	0.0870	0.0015
Granite from Milford, Mass., in sealed case..	0.0085	.....	.....
Marble from Marble Hill, Ga., " ..	0.0285	.....	.....
18 Varieties of Brick, from several States...	0.0133	0.0433	—0.0017
12 " " " ...	0.0213	0.0433	0.0050
*5 " " " ...	—0.0027	—0.0033	—0.0017
†Temporary elongation while frozen soaked, of 22 varieties of brick made by 10 different manufacturers in various States.....	0.0493	0.1033	0.0100

Note.—* The minus (—) sign in this series denotes a permanent *contraction* after having been frozen; and the quantity of water absorbed after immersion for one week ranged from 5.5 to 13.5 per cent., with average of 9.7 per cent.

† The quantity of water absorbed after immersion for one week ranged from 4.6 to 19.5 per cent., with average of 10.2 per cent.

To eliminate the effect of the permanent swelling described above and obtain coefficients of expansion for the wet material, due principally or solely to change of temperature, the values of the coefficients were computed from the *contractions* of the samples while returning from the temperature of the hot bath to that of the cold bath. The results are given in the following table, to which the coefficient of a few common metals have been added for convenience of comparison:—

Watertown Arsenal Coefficients of Expansion by Heat, per Unit of Length and 1° F., of Various Stones and Building Bricks in Saturated Condition.

Materials.	No. of Determinations.	Coefficient of Expansion by Rise of Temperature 1° F. Aver.	Max.	Min.
12 Varieties of Granite, from several States	14	0.00000385	0.00000461	0.00000311
11 Varieties of Marble, from several States	12	0.00000400	0.00000634	0.00000185
11 Varieties of Limestone, from several States	13	0.00000356	0.00000596	0.00000058
15 Varieties of Sandstone, from several States	16	0.00000518	0.00000686	0.00000177
22 Varieties of Brick from several States	22	0.00000351	0.00000749	0.00000205
4 Varieties of Red Brick, not in preceding	4	0.00000296	0.00000351	0.00000255
2 Varieties of Fire Brick, not in preceding	2	0.00000266	0.00000289	0.00000244
Ashler Brick E_1, Boston, Mass.....	1	0.00000185	.....	.....
Hollow Fireproof Brick, St. Paul, Minn.....	1	0.00000291	.....	.....
North River Bluestone, State of New York.....	1	0.00000596	.....	.....
Slate, Monson, Me.....	1	0.00000500	.....	.....
Oolitic Limestone, Bedford, Ind...	1	0.00000375	.....	.....
Brown Sandstone, Portland, Conn..	1	0.00000526	.....	.....
White Granite, Quincy, Mass.....	1	0.00000381	.....	.....
Wrought iron.....	1	0.00000673	.....	.....
Mild Steel (varies with amount of Carbon)	5	0.00000664	0.00000676	0.00000651
Hard Steel (varies with amount of Carbon)	5	0.00000630	0.00000647	0.00000617
Cast iron	1	0.00000593	.....	.....
Copper	1	0.00000913	.....	.....

It may also be remarked that the coefficients of expansion of crystallized minerals are not the same in the direction of the various axes of crystallization. Thus in quartz the coefficient is 0.00000769 in the direction of the major axis, and 0.00001385 perpendicular thereto; for the three axes of feldspar, the coefficients are 0.00015600, 0.00000066, and 0.00000294; and for those of hornblende, they are 0.00000810, 0.00000084, and 0.00000950. Dana states in his *Manual of Geology*, New York, 1895, p. 259, that the expansion of rocks is mostly between 1 and 10 millionths for 1° F.; and after referring to the above-described experiments of Totten and Adie, he cites those of Pfaff, from which the total expansion, between the ordinary temperature and red heat (about 1,750° F.), was found to be 0.0168 for granite, 0.0127 for porphyry, and 0.0120 for basalt. He also refers to the diurnal motion of the top of Bunker Hill Monument, caused by the heat of the sun. Similar observations have likewise been on the Washington Monument and the dome of the City Hall in Philadelphia.

Expansion of Coping Stones of Masonry Structures

The effect of solar heat in causing a gradual and apparently permanent expansion or elongation of the coping stones of long walls has often been noticed. In some cases it is manifested by the rising of two adjacent stones at intervals of a few hundred feet, and in others by a marked increase of overhang at the ends of the structure. An interesting example is afforded by the coping on the west side of the canal aqueduct over the Mohawk River, at Crescent, N. Y., as reported by A. G. Himes, C. E., in *Engineering News* for 1897, vol. 38, p. 42. This fine specimen of masonry, completed in 1842, is 1,137 feet long, and is founded throughout on firm rock. At a point somewhat north of the middle of the structure, one of the cut limestone coping stones, which are all about 10 inches thick and more than 4 feet long, has been lifted bodily nearly ½-inch from its seat on the parapet, and remains permanently suspended at all seasons of the year solely by the pressure on its ends, as a broad streak of light is always found underneath. This condition was observed on March 8, 1897, when the temperature was at the freezing point, and also during a very warm period in the following May and June. The ends of some of the adjacent stones appear to be badly disintegrated by the compressive force, and the remarkable feature is that when the work was examined on both occa-

sions, all of the joints in the coping were found to be so tight that a knife-blade could not be inserted, except in a distance of about 50 feet at the north end.

At every pier a pilaster was carried up on both faces of the aqueduct, and the coping was presumably cut and placed in the outset so as to show an equal projection at all these places. The present positions of the pilaster copings at points 528 feet each way from the middle, however, indicate a permanent elongation of 5.75 inches at the north, and 8.50 inches at the south point, thus making a total elongation of 14.25 inches in a length of 1,056 feet. No record of the first occurrence of these displacements is available, but it is known that they have existed for many years. It has been suggested that the movement of the coping was caused both by rise of temperature and by the freezing of water in the joints. For computing the former, we have the following coefficients of expansion of limestone:—0.00000(417 and 494), given by Bouniceau; 0.00000(780 and 662), given by Adie for moist white marble; 0.00000567, given by Totten, and 0.00000596, the maximum of the Watertown Arsenal experiments. The average of these six values is 0.00000586 per 1° F., and if we assume that the highest summer temperature of the stones is 60° F. higher than that at which they were originally set in place, the temporary expansion of a length of 1,056 feet of the coping will be only 4.46 inches. To this we may add the permanent elongation or set due to heating from 0° to about 110° F., for which the average value 0.035 per cent. found at the Watertown Arsenal may be taken, in the absence of better data, thereby obtaining 4.44 inches, and hence a total of 8.90 inches for both temporary and permanent elongations by heat.

The displacement by the formation of ice in the joints of the coping stones can here be neglected, as it is explicitly stated that they are always very tight. If this be true, it must follow that the permanent swelling of the limestone by exposure to the atmosphere is much greater than the aforesaid percentage (0.035) or even the reported maximum percentage (0.0595), since the probable permanent elongation of the coping is 14.25 inches, as mentioned above. Concerning the expansive force of water freezing in open joints where it is not fully confined, we have, on the one hand, the statement of Professor Geikie and other authorities that the same is about 215 pounds per square inch, and on the other hand, the resistance of the coping to displacement due to friction and adhesion or shear of the mortar bed joints. Taking the weight of the limestone at 140 pounds per square foot for a thickness of 10 inches, the quiescent friction at 66 per cent. thereof, and the ultimate shearing strength of the indurated cement mortar at only 50 pounds per square inch, the total resistance will be about 7,296 pounds per square foot; hence if each stone is at least 4 feet long, the resistance per square inch of its end face will be 243 pounds, or somewhat greater than the ice pressure estimated above. It therefore follows that if the said stones had all been properly bedded in good cement mortar, the joints originally would not tend to open by the ice pressure alone.

It must be remembered, however, that the coping has undoubtedly moved several inches at each of the two points named, and hence that the adhesion of the bed joints has been destroyed, leaving only the relatively small frictional resistance to oppose any expansive force. At the rate mentioned above, this friction in a length of 100 feet of coping is equivalent to only about 78 pounds per square inch of end joint surface, so that a length of 276 feet is needed to resist an ice pressure of 215 pounds per square inch if all the joints were slightly open in winter. For a greater pressure the length must obviously increase proportionally. Taking the modulus of elasticity of limestone at 6,800,000 pounds per square inch, the elongation of 4.46 inches computed above for a rise of 60° F. will correspond to a compressive force of about 2,400 pounds per square inch in the joints, which is ten times more than the computed shearing resistance, and will require a length of nearly 3,100 feet to be overcome by friction alone. From these considerations of the expansive forces which act upon long stone copings, it is evident that no dependence can be placed on any permanent adhesion at the bed joints, and that more or less motion of the ends must result from expansion by heat. In the case of the aqueduct mentioned above, the large permanent elongation of the stones, together with the tightness of the joints, indicates that a swelling took place far in excess of what has hitherto been determined by laboratory experiments.

In antithesis to the foregoing, reference may also be made to the shrinkage of the concrete coping of a small reservoir in consequence of drying in the open air in midsummer, as reported by E. Low, C. E., in *Engineering News* for 1894, vol. 32, p. 322. This coping was laid in the latter part of June as a monolith, 18 inches wide and 6 inches thick, on the four sides of a square with its corners rounded to a radius of 20 feet, the length of each straight side being 40 feet, and the total length 285.7 feet. The foundation was partly a brick slope-pavement and partly the broken stone and clay backing of the same, so that there was little adhesion. The concrete was made of one part Atlas Portland cement, 1.10 parts sand, and 2.52 parts broken stone, properly mixed with water and rammed. Not long after its completion, cracks began to develop in the coping, until finally 15 fissures were formed squarely across it, ranging from 1-16 to 3-16-inch in width. These cracks were about 10 feet apart on one of the straight sides, and from 20 to 30 feet apart on the three other straight sides, besides which from one to two cracks appeared in each of the long curves. The average temperature was about 80° F. while the concrete was being laid.

Assuming that the aggregate width of these 15 cracks in a length of 285.7 feet was 1.75 inches, the total shrinkage of this rich concrete by desiccation in midsummer was 0.051 per cent.; and by referring to the experimental data previously given for the contraction of cement mortars drying in air without change of temperature, it will be found that fully as much may be expected within six or eight weeks under like conditions. The case is therefore in very good accord with the results of experiment on much smaller scale.

(*To be continued.*)

TESTING CEMENTS AND ASPHALTS

Digest of a Valuable Report—Rules and Uniform Methods Recommended by an Expert

By Prof. A. W. Dow

The report of Prof. A. W. Dow, Government Inspector of Asphalt and Cements of the District of Columbia, for the year ending June 30, 1904, shows 398 samples of natural cements tested, of which 368 were of the Cumberland brand and ten each on test samples of Cumberland, Cumberland and Potomac and Shield brands. In these the residue from a 100-mesh sieve varied from 2.7 per cent. for the Shield to 17.4 per cent. for the Cumberland; the initial set was 10 m. for the Cumberland to 55 m. for the Shield; water used, neat cement, 26 per cent. Shield to 31.3 per cent. Cumberland and Potomac, and two parts sand, 9.4 per cent. of the former to 13.4 per cent. of the later: the tensil strength at seven days for Neat cement ranged from 295 for Cumberland to 316 for Shield, and at seven days for two parts sand at 101, Cumberland, to 203, Cumberland.

Of Portland cements 9,456 tests were made of seventeen different brands. The residue from a 100-mesh sieve varied from 2.9 per cent., Old Dominion, to 7.9 per cent. for Vulcanite: the initial set for Clover Leaf was 60 m., and for Alpha, 3 h. 40 m.: the tensil strength of Neat cement at seven days ranged from 609, Heyn, to 939, Atlas, and of three parts sand at seven days, 250, Atlas, to 397 for Vulcanite.

All fluxes used for softening asphalts were included under the head of Petroleum residuum; thirty-five samples were examined for three paving companies, all being manufactured either by the Sun Oil Company or the Standard Oil Company.

Refined Land Trinidad asphalt yielded a test of 51 per cent., bitumen soluble in carbon disulphide, while crude Cuban gave an average of 75.34 per cent., and Maricaibo gave 93.69 per cent.

The range of penetration for asphalt topping cement was from 39.3 for Maricaibo, to 54.0 for Cuban; and of asphalt binder cement, from 43.0 for Lake Trinidad to 80.0 for Bermudez.

Continued investigations, especially of new products, have made it advisable to modify the radical specifications for asphalt paving adopted the year before, and the amended paragraph now reads as follows:

Asphalt Cement.—The asphaltic cement must be practically free from water and must be within range of forty and seventy penetration when tested at 77° F., the amount of penetration to be fixed by the Engineer Commissioner.

Preference will be given to an asphaltic cement that is not readily affected by water, provided it is satisfactory in other respects. If an asphaltic cement is accepted that is affected by water some provision satisfactory to the Engineer Commissioner must be made to guard against the results of such action, and such work must be included in the price bid.

If an asphalt has been proposed for use by the contractor and approved by the Engineer Commissioner, no change in the asphalt to be used shall be made unless with the approval of the Engineer Commissioner. If an asphalt is submitted for use, which has not been successfully used for a period of at least two years for paving under conditions similar to those existing in the District of Columbia, its use may be limited to such extent as may be deemed advisable, or it may be rejected entirely in the discretion of the Engineer Commissioner.

The bitumen of the asphaltic cement must comply with the following tests:

1. It must be of such a character that if when tested at 32° F., it shows a hardness of 10 penetration, it must not when tested at 115° F. be softer than 350 penetration.

2. When a briquette of pure bitumen having a minimum cross section of one square centimeter is tested for ductility at 77°, the bitumen must stretch to a distance of eight centimeters before breaking.

3. When the bitumen is heated in an open tin at a temperature of 300° F. for eighteen hours in a hot-air oven, it must not show a loss by volatilization of over five per cent., and it must not have been hardened over 50 per cent. by this heating.

The asphaltic cement must never be heated to a temperature that will injure it.

When the asphaltic cement contains over five per cent. of material that will separate by subsidence while in a molten condition, it must be thoroughly agitated before drawing from storage and while in use in the supply kettles so as to insure a uniform cement.

Rules and Uniform Methods

If an asphaltic cement contains over 96 per cent. bitumen soluble in carbon disulphide and is free from lumps of inert bitumen, it shall be considered as sufficiently pure to test. When the asphaltic cement contains less than 96 per cent. bitumen, and the bitumen is homogeneous or nearly so, that is, contains no lumps of inert bitumen, a pure bitumen sufficiently corresponding to that contained in the asphaltic cements may be obtained by the following method:

Sufficient quantity of the refined hard asphalt, before having been fluxed, to yield 150 grains of bitumen is treated with carbon disulphide in an Erlemeyer flask. After standing in the solvent for two or three hours the flask is shaken until none of the asphalt is seen adhering to the sides or bottom, after which it is set aside and allowed to stand twenty-four hours. The solvent is then decanted carefully off from the residue into a second flask. The residue is again treated with the solvent, shaken, and allowed to subside and decanted as before. This is continued until the solvent is practically colorless or of a light

straw color. The solvent is then distilled off until only sufficient remains to keep the extracted bitumen liquid. It is then poured into a large evaporating dish and as much of the remaining solvent evaporated as is possible on a steam bath. To facilitate the removal as well as is possible of the last particles of carbon disulphide from the bitumen while on the steam bath, it should be stirred from time to time. After this treatment on the steam bath one-half to one centimeter of water should be incorporated into the bitumen and the heating continued over a burner until all foaming ceases, after which the dish containing the bitumen should be placed in a hot-air oven and kept at 300° F. for thirty minutes. While heating the extracted bitumen over the burner it should be stirred constantly with a thermometer and care exercised that the temperature never exceeds 300° F. The pure extracted bitumen is then softened with sufficient flux to bring it to a consistency of fifteen penetration at 32° F., when it can be tested by the method described below.

When the bitumen of the asphalt cement is not homogeneous, that is, when it contains lumps of hard bitumen which can not be brought into solution in the softer bitumen even in a melted condition, it is impossible to obtain a pure bitumen that will have the same relative physical properties as the active bitumen of the cement. Such an asphalt cement shall be refined by passing it while in a molten condition through sieves, thus removing the coarser lumps of inert bitumen. This shall be accomplished by heating the asphalt cement in an air bath at a temperature between 300° F. and 350° F. along with a 20-mesh and 50-mesh sieve. When the cements is in a thoroughly molten condition it is first strained through the heated 20-mesh sieve and afterwards through the heated 50-mesh sieve. The molten cement must not be forced through the sieves, but must run through by gravity.

The tests given in the specifications shall be made either on the commercially pure homogeneous asphalt cement or on the pure bitumen cement obtained by extracting the asphalt with a solvent or the purified bitumen from the non-homogeneous asphalt cement obtained by straining through the sieves.

(1) *Consistency.*—Consistency, viscosity, or penetration of an asphalt cement or bitumen at 32° F. shall be determined by ascertaining the distance stated in hundredths centimeters that a No. 2 needle will penetrate into the material under a weight of 200 grams operating for one minute.

The consistency, viscosity, or penetration at 115° F. shall be ascertained by determining the distance stated in hundredths centimeters that a No. 2 needle will penetrate into the sample under 50 grams of weight acting for five seconds.

The consistency, viscosity, or penetration at 77° F. shall be ascertained by determining the distance stated in hundredths centimeters that a No. 2 needle will penetrate into the sample under a 100-gram weight acting for five seconds.

The consistency, viscosity, or penetration at 32° F., 77° F., and 115° F., shall be ascertained by a penetration machine, now in use in the office of the inspector of asphalts and cements and described in the report of the inspector of asphalt and cements for the year ending June 30, 1901. The tests shall be made in the following manner: The samples to be tested are immersed in a freezing mixture or water at the desired temperature, and kept at such temperature for at least thirty minutes before testing. The sample to be tested shall then be placed in a glass dish and removed in it, covered with the freezing mixture or water at the desired temperature. The glass dish containing the sample is then placed on a shelf of the machine, and the penetration of the sample determined as described in the report spoken of above. The temperature of the water surrounding the samples in the glass dish shall be taken after each test, and no determination shall be considered if the temperature varies more than one-half of a degree from the standard.

(2) *Ductility at 77 F.*—The ductility of an asphalt cement or asphalt cement bitumen shall be determined by the distance in centimeters that a briquette of the material will draw out before breaking. The asphalt cement or bitumen to be tested for ductility must first be brought to a consistency of 50 penetrations when tested at 77° F., by softening it with a flux similar to that which it is proposed to use in the practical work, and the test for ductility shall be made on this prepared asphalt cement or bitumen.

The briquette of the asphalt cement shall have the following dimensions: One centimeter in thickness throughout its entire length, distance between clips, three centimeters; width of asphalt cement section at mouth of clips, two centimeters; width at minimum cross section half way between clips, one centimeter. The molding of this briquette shall be done as follows: The mold shall be placed on a brass plate. To prevent the asphalt cement from adhering to this plate and the inner sides of the two pieces of the mold *a* and *a'* they shall be well amalgamated. The asphalt cement to be tested is poured into the mold while in a molten state, a slight excess being added to allow for shrinkage on cooling. After the asphalt cement is nearly cooled, the briquette is smoothed off level by means of a trowel, which should be wet with water to prevent its sticking. When it is thoroughly cooled to the temperature at which it is desired to make the test, the clamp and the two side pieces are removed, leaving the briquette of asphalt cement held at each end by the ends of the mold that now play the part of clips. The test is made by pulling the two clips apart at a uniform rate of speed by means of hooks inserted in the eyes. The briquette shall be kept in water at 77° F. for at least thirty minutes before testing, and the test shall be performed while the briquette is so immersed in the water at the above temperature, and at no time shall the temperature of the water vary more than one-half a degree from the standard temperature. The clips shall be pulled apart at the rate of 5 centimeters a minute until the thread of asphalt cement has parted. The distance between the clips shall then be measured and shall be known as the ductility of the asphalt cement.

(3) *Heat Test.*—The test for determining the change in the consistency of an asphaltic cement on being heated at high temperatures, and also the loss due to this heating, shall be made in the following manner: Fifty grams of

the asphalt cement bitumen shall be weighed into a small tin box with vertical sides measuring two centimeters deep by six centimeters in diameter, internal measurement. The consistency of the asphalt cement or asphalt cement bitumen, shall be determined by penetration at 77° F. The sample in tin box will then be put into a hot-air oven heated at 300° F. The sample being tested shall be kept at this temperature for eighteen hours. During the last two hours of this time the sample shall be stirred each hour with a small stirring rod. At no time must the temperature of this hot-air oven vary more than 15° from 300° F. When the sample has been heated for the full eighteen hours it shall be removed from the oven and well stirred with the iron stirring rod, and put to one side to cool. The asphalt cement bitumen adhering to the stirring rod must be carefully scraped off and added to the tin containing the sample. When the sample has cooled to normal temperature it shall be weighed, and the per cent. loss by volatilization calculated. After this the consistency by penetration at 77° F. shall be again determined as described above. The difference between the penetration of the sample before and after heating, divided by its penetration before heating, shall be considered the per cent. of hardening resulting from the heating in the open tin at 300° F. for eighteen hours.

Action of Water on Asphaltic Cement.—The commercial asphaltic cement, as it will be used in practical work. shall be tested to determine the extent to which it is acted upon by water. To determine whether an asphaltic cement is readily acted upon by water, it shall be coated on a piece of glass and immersed in distilled water at a temperature between 70° F. and 90° F. If the surface of the asphalt cement remains bright and shows no corrosion or discoloration from an immersion of seven days, it shall be considered as not being readily affected by the action of water.

MUNICIPAL INSURANCE IN ENGLAND*

Important Lessons to Be Learned from English Experience—Why the Movement Succeeds

Enemies of a full civic life, who are always ready to rush in and show the evils and dangers of municipal activity, have run their heads against a wall in attacking the Municipal Mutual Insurance, Limited. As we were the first to announce the risk in regard to the fire at the Shoreditch Town Hall, the headquarters of the undertaking, had been heavily underwritten, and the net loss falling upon the Municipal Mutual Insurance, Limited, will not absorb more than one-fourth of the first year's reserves. Owing to this careful policy, the working of which has been more than once explained in our pages, only one-twentieth of the £20,000 involved is retained by the association, and consequently the indebtedness is only in that proportion.

The "Times" Says Not Municipal Enough.

But even this careful policy does not suit the *Times,* which in this case completely changes its usual cry of municipal recklessness, and apparently upbraids this municipal association because it is not sufficiently municipal. This is what it says in its financial and commercial supplement of Monday last—a new feature which has already proved itself worthy of better things:

"It happens that the Municipal Mutual Insurance Limited —the association formed for the purpose conveyed by its title—has lost a very small amount in the fire, and for the simple reason that it ran only one-twentieth of the fire risks on the Town Hall. Two policies on the Town Hall were effected with the Mutual Association—one for £20,000 on the old building (the part affected) and another, also for £20,000, on the new extension. But as the building, by reason of its environment, was regarded as somewhat risky, the Municipal Mutual Insurance, Limited, reinsured in the ordinary channels nineteen-twentieths of the risk, retaining only one-twentieth, or £1,000, on each policy.

The promotors of the mutual scheme regard with great satisfaction the fact that the first bad fire has not smashed up the whole affair, but they do not apparently reflect that they have only been saved from disaster by not carrying out the objects of their scheme. These objects were to insure mutually municipal property, and it appears that one-twentieth part only of the Shoreditch Town Hall was mutually insured, the companies covering the rest.

The incident justifies fully the contention of critics that safety in fire insurance is only possible by spreading risks over the widest possible area, and that any attempt on the part of the Municipal Mutual Insurance, Limited, to run large lines must inevitably be attended by disaster. This criticism has clearly been taken to heart, and if the municipal insurers continue to carry lines proportionate to their resources—as in the Shoreditch case—there is no reason why their operations should not be attended with success. But it will necessarily be success on rather a minute scale."

The most plausible argument is the one which reveals part of the truth. If the *Times* had revealed the whole truth, it would have shown that the Municipal Mutual Insurance, Limited, is using precisely the same machinery as all newly-started insurance companies use, and, in fact, the same machinery as all insurance companies use, with the exception of one or two of the very oldest established. By its system of underwriting it bears only a proportion of the risk, and that proportion becomes larger as the undertaking becomes more firmly established. One of the reasons why the anti-municipal element is so strongly pitted against this movement is because it is fighting the companies with their own weapons. Employing the underwriter, the *Times*

* From *The Municipal Journal,* London, Eng.

thinks, is not "carrying out the objects of their scheme." Possibly our contemporary would like to see this municipal association using other and less safe methods. But there is really nothing in the gibe, for, as the *Times* ought to know, the underwriters' terms are much less onerous than the insurance companies', and the one object of saving the ratepayers' money without risk is thus achieved.

So much for the *Times;* but even the most ardent anti-municipalist will blush, we should imagine, at the following distortion of facts put forward by a paper whose tactics we have more than once had to expose. We mean the *Manchester Courier,* which is always open to the articles of the Industrial Freedom League:

"Many officials who were open to conviction in regard to the advantages of municipal fire insurance have had their views on the subject considerably prejudiced, to put it mildly, by the early disaster that has overtaken the newly-constituted organization of municipal bodies for the insurance of public property. In the face of much expert criticism the "Municipal Mutual Insurance, Limited," was started, several London borough councils being joined in this nice little gamble with the rate-payers' money by some provincial towns, including Bolton, Nelson, Keighley, and Halifax. The scheme was originated by the Borough Council of Shoreditch, and probably, in graceful recognition of this fact, policy No. 1 was issued to insure the town hall of that borough. By a cruel irony of fate the first serious claims fall under that policy, the partial destruction of the building representing a loss estimated at £20,000. The organization is in its infancy, and has no funds, so that the damage will fall upon the ratepayers. This object lesson in corporate trading is an interesting one. The bitterness of the blow to these aspiring municipal traders must be accentuated by the fact that the salvage corps—which is entirely supported by the insuranse companies—went to their aid and did good work, for which a considerable bill will be presented."

The Fire Actually Welcomed.

So far from this "bitter" blow falling upon the ratepayers, three more such fires, as we have shown, would not strain the resources of the Mutual. In fact, so far from the loss even causing anxiety, it is welcomed as affording a real test of how a scheme of mutual insurance can meet a heavy loss without any more difficulty than that experienced by ordinary insurance companies. Indeed, so strong is the Municipal Association under its further safeguard—an indemnity contingency policy—that the sufficiency of its reserve fund is guaranteed to meet every claim, and upon this it could fall back if by any possibility its reserve fund were exhausted. If every property now insured in the Mutual were wholly burned down, the cash to restore them would be immediately forthcoming. And only 5 per cent. on the premium income insures this "second line of defense."

"I Think Him So, Because I Think Him So."

To talk, therefore, of coming on the ratepayer for this Shoreditch Town Hall claim is worse than foolish, it is wilful misrepresentation.

Besides these two strangely contradictory and mutually destructive attacks on municipal insurance, there is another from a third quarter. This is in the nature, not of argument, but of pure assertion. It comes from our old friend the *London Argus,* and is in these terms:

"The damage caused by the fire in question is believed to be £20,000, and it is quite out of the question for the company to meet such a claim out of its own resources. The company was registered in March, 1903, by a number of metropolitan municipal authorities to carry out a scheme for insuring public buildings. The original premium income anticipated from the covering of risks in connection with various properties was £3,000,000, and the annual premium income £3,000. According, however, to a statement by the chairman last October, the actual business was much less than this.

"It is therefore evident that, whatever the expenses may have been, the funds in hand cannot be anything like sufficient to pay such a claim. It must be remembered, however, that, according to the scheme, it was not intended to retain a risk of more than £5,000 on any single policy, any excess above that amount being re-insured with non-tariff offices. Even with such a safeguard, however, in itself a great admission of weakness, it is difficult to see how even £5,000 can be provided. Last October it was stated that a profit had been made, but no particulars were given, and its amount at best must have been much below the large sum now involved. It is possible, of course, that the whole of this particular risk has been underwritten, and so the company may have been saved from loss by a practical abnegation of its own principles. In any case, the incident is important and significant."

To such extraordinary change of face as this paragraph reveals as it proceeds, it is impossible, and indeed superfluous, to reply. We agree, however, with the conclusion that "the incident is important and significant." It is important and significant, as we have shown, as showing the success and safety of the Municipal Mutual Insurance, Limited.

PROBLEM OF STREET INTERSECTIONS

Different Methods of Establishing Street Grades—The Question of Sidewalk Grades

*By Prof. Lafayette Higgins**

EVERY engineer doing street work realizes that there are impossible problems connected with street intersections. Yet there has been a hope that some method might be devised that would be accepted as a satisfactory one and thus bring uniformity in work. The trouble about this is, that there are too many doctors, each of whom dogmatically defends his own treatment, decries the treatment of others, while the suffering patient endures or dies, as the case may be.

We have a right to assume that a practicing engineer has some education and is reasonably intelligent. If so, he should be a reasonable being. It is with such that I now propose the topic chosen, but not with the assumption that we can accomplish the impossible.

Let us also keep in mind that the plan adopted for a well improved city may not be the plan best adopted to the small city or town.

There are three distinct methods of establishing street grades, namely:

1. By center lines. 2. By curb lines. 3. By lot lines. The order given is also, I believe, the order of their development in engineering.

The first method has almost nothing in its favor. Naturally the intersection of center lines would give the elevation at which the intersection should be finished, and just as naturally this elevation was changed by the engineer, in improving the street, simply because of the impossible. This necessary modification became food for the lawyers, and in the case of Given vs. The City of Des Moines, reached a culmination in a supreme court decision in 1886. This case is much misunderstood by engineers, and it may have been misunderstood by the court that rendered the final decision. Yet the supreme court is supreme and no engineer can be its equal or its superior.

An engineer should read all the evidence in this case as well as the final decision before passing judgment. This is seldom done, and frequently the engineer blunders as a result.

It is sufficient here to say, that the court decided that where the ordinance established the grades of the streets by center lines, the intersection of such center lines determined the "plane upon which the street should be improved." What does that mean? Some engineers have thought that *plane* means a *point* or elevation at the point of intersection, and act accordingly. How absurd. A *plane* is a *plane*, not a point, and the *plane* of intersection is meant. Therefore a strictly correct interpretation of that would be a *plane parallel* to the *datum plane*, or a level intersection. The decision was so interpreted by the intelligent engineers, and more trouble appeared. There are few places where a level intersection is the proper thing, one of the intersecting streets should always have a sloping grade, and both should slope if possible. Hence, the absurdity of the level intersection as an absolute rule or method.

Many of the engineers handling the problem of center lines introduced the "ruling street" method in the ordinances. This was sometimes a refuge, sometimes a subterfuge, and at all times more or less of a failure, because of the impossible. Every intelligent engineer now knows that the center line grade method is a failure and should no longer be written in grade ordinances, but there yet remains the work of improving the streets where such method has been used; therefore, the trouble seems almost perpetual. All such ordinances should be re-written, preserving the intent of the original ordinance as to frontage elevation along the street between intersections. If this be illegal, there should be a legalizing act to make such action legal. Common sense and the intelligent engineer can do the rest.

The second method, the method of curb lines, is a good method. The elevations are usually given for curb corners and grades to run uniformly between the elevations given. Where the grades do not change at intersections, the method is perfect. Where a street changes grade at intersection, there is trouble. Ordinarily this is not serious. In a very hilly town the grade must be lightened at intersections, and possibly the curb lines should be broken at street lines to give safe sidewalk approaches. If so, the proper elevation of curbs at *street lines* should be placed in the ordinance instead of elevations at *curb corners.*

In this, as before stated, intelligence on the part of the engineer will be sufficient. The second method allows the given elevation to govern the intersection, but does not wholly solve the problem. Here again the impossible sometimes appears.

In both of the methods discussed, the problem of sidewalk grades is not solved. The common provisions for sidewalk grades are defective. An arbitrary rule of one inch rise in four feet, rising from the curb towards lot line sounds easy, but is frequently the cause of trouble. Any such rule should be flexible. There can be but one grade for sidewalk at a block corner, and this should be higher than any point of the curb running around such block corner, so that the water will always drain *from* the building or sidewalk on that corner. Then sidewalk lines ordinarily should run uniformly between such sidewalk elevations as are given at the block corners. There may be intermediate grade points in a block. This will present no difficulty.

I think it will be readily seen that an ordinance could cover all the difficulties here involved, but without such ordinance much trouble will arise. If there be a provision for maximum grade of sidewalk approaches, this may compel a break in the curb line, unless the approach be laid above the curb which is frequently the best thing to do. Yet a grade ordinance can anticipate and provide for all these difficulties in a satisfactory manner. The only trouble seems to be that the engineer, ignorantly, carelessly, or unintentionally leaves the

* Des Moines, Ia.

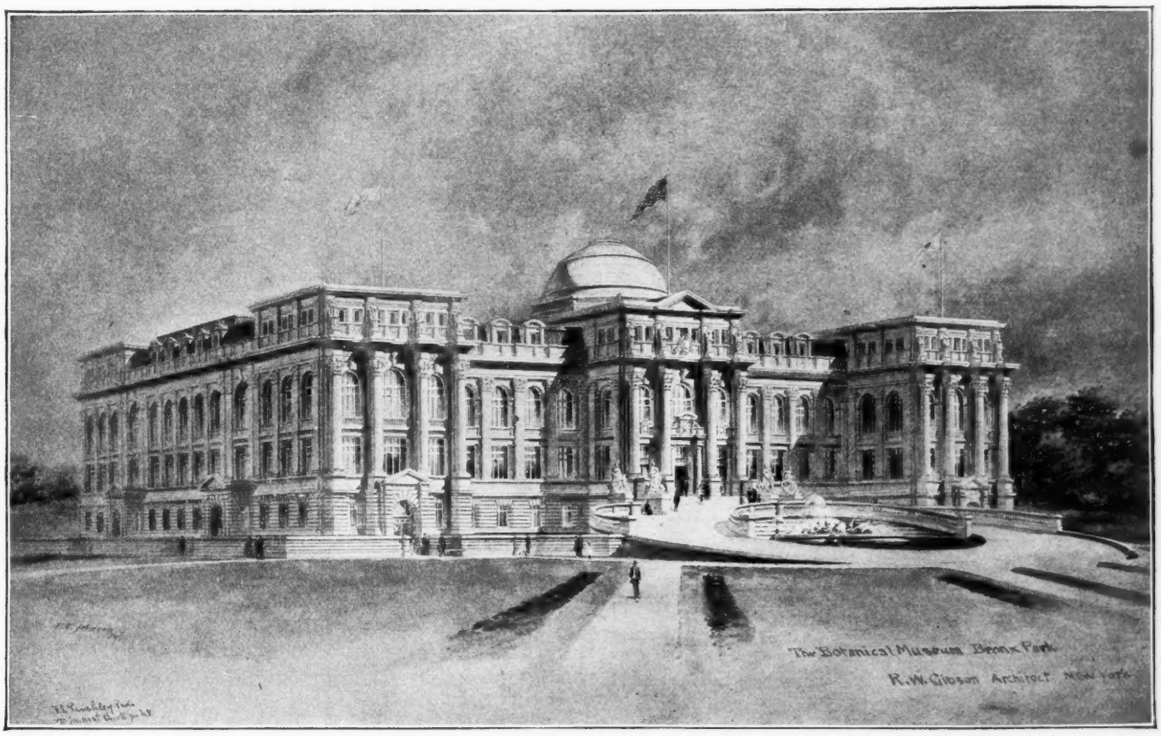
difficulties to the future, instead of comprehending them from the beginning.

The third method, or method of establishing grades at lot lines. This gives definite elevations at block corners, and at intermediate points on lot lines. Elevation of sidewalk above these can be fixed by a flexible method provided by ordinance. If the intersecting streets do not change grade, the curb lines will not break at street lines. If uniform curb lines are desired between curb corners, this can also be provided by ordinance, but occasionally this will make some trouble at the street intersection. It is possible to make suitable intersections in nearly all cases, but once in a great while the impossible will appear. If the engineer understands all of the difficulties likely to be encountered, he can write an ordinance with the necessary provisions. I have worked under all of the methods. I prefer the latter method for the larger city work, because of fewer resulting difficulties. I think, however, that the second method of establishing grades, the curb corner method, is probably the better method for small cities or towns. In all cases where possible, *no grades should be established* until profiles are made for *all* the *streets* of the city or town. Then the claims of each street can be regarded and each intersection studied, its grade elevations determined, and platted, and incorporated in the ordinance. Also all sidewalk grade requirements, flexible of course, should appear in the ordinance.

In conclusion, let me repeat, that we are working with an impossible problem, and our solutions are simply arbitrary and must be suited to the case in hand. We do the best we can and violate geometry of engineering as little as possible.

We have three things to consider. First, safety to human life; second, surface drainage; third, the demands of traffic. It may be that the first necessarily includes the second. It certainly would in a town of difficult drainage. Proper surface drainage is a necessary sanitary precaution. Aside from this, the safety of pedestrians is paramount. This demands careful engineering in sidewalk grades. The judgment fund of a municipality is largely determined by the character of its sidewalk grades.

Finally, the intelligence and skill of the engineer must be sufficient for the approximate solution of the problem of street intersections, and if he possesses not the necessary intelligence and skill, it would seem better that he abandon the profession of engineering in the municipality, and it may be that he could adjust himself more perfectly in some other profession than that of engineering.



THE BOTANICAL MUSEUM, BRONX PARK, NEW YORK CITY.—IN THE CONSTRUCTION OF THIS HANDSOME MUNICIPAL BUILDING GIANT PORTLAND CEMENT WAS USED EXCLUSIVELY

CITY MADE CHARTERS*

A Study in Municipal Home Rule—Its Origin and Development as Given by an Expert—Continued

By Milo Roy Maltbie, Ph.D.[1]

MILO ROY MALTBIE

THE position of the city in American jurisprudence is theoretically one of complete dependence upon the will of the State legislature, except so far as municipal rights may be guaranteed either by the constitution of the State or of the United States. Barring express prohibition in one of these instruments, the legislature may extend or contract the boundaries of a city at will, may slightly modify or completely revolutionize its government, may restrict or expand its functions, may create or annihilate, and no one may say it nay.[2]

This power of legislature has been exercised so freely that it has escaped all bounds. There is scarcely a single item in municipal administration, from the construction of a $20,000,000 city hall to the increase in the salary of a bridge-tender from $600 to $720, which has not at some time and in some State been the basis of action by the legislature. Officers appointed by State departments have ruthlessly been substituted for officers elected locally by the people. The construction of public works has been ordered and forced through, even though the locality opposed it and though there was no need for it; and in the same breath an urgent appeal for authority to perform some pressing duty has been overwhelmingly denied. Municipal revenues have been diverted into the State treasury, and cities have been made to contribute in various ways a larger and larger proportion of the cost of public works in far distant rural districts. The minor matters of city government also come in for their share of attention. A policeman has been discharged for misconduct; the legislature orders his reinstatement. An easy berth for a political leader is wanted; the legislature obliges the district leader at an expense of $1,250 per year, regardless of the city's wishes. A claim against the city has been thrown out by the courts; the legislature directs the payment of the claim. A corporation wants an alley for a switch yard or a franchise in the principal city street and cannot get it from the city authorities without paying a small sum; the legislature, solicitous of the development of the city, grants the request and imposes no obligation whatever in return.

If these were widely scattered instances, they would not deserve notice here, however exasperating they may be to the locality in question. But they are so common and of such long standing that they do not attract attention ordinarily. Legislative interference antedates by far the present generation, dating back to 1850 and beyond. The members of constitutional conventions for several decades have found it a nightmare, and following the line of least resistance, have inserted provisions in many constitutions prohibiting the enactment of laws interfering with municipal affairs. This is not the place to point out how and why this plan has failed; suffice to say that it has failed, and that its failure is now generally recognized. A few far-seeing students perceived the inadequacy of this remedy a generation ago and adopted another method of procedure. It is this plan for securing home rule through constitutional provisions empowering a city to frame its own charter that is the subject of this paper.

ORIGIN OF SCHEME IN MISSOURI

A constitutional convention for Missouri met in 1875. Legislative interference in municipal matters had characterized its history as it had the history of other States. The government of St. Louis, the principal city, had been notoriously bad. The demand for radical treatment was general, and the St. Louis delegates came to the convention determined to compel the country members to give them some relief. One of their number promptly introduced a resolution that cities of 100,000 population and over (St. Louis was the only city to which this could apply at that moment) should have "a fundamental constitutional charter" which should not be altered by the legislature unless such amendment should be proposed by the concurrent vote of two-thirds of the members of the city council and the mayor, and be endorsed by a two-thirds vote of the people at a special election.[1] Such a scheme undoubtedly would have put an end to legislative tinkering. St. Louis also wished to be separated from the county of which it was a part and which had taxed it so constantly for improvements beyond the city limits. The proposition was also opposed by the country members, who wanted to curtail the power and influence of

* Since this article first appeared in the *Yale Review* the Constitutional Home Rule committee of New York City has been formed with the following gentlemen as officers: John G. Agar, president; Herman A. Metz, vice-president; Milo R. Maltbie, secretary. As stated in the constitution of the committee: "The objects of the committee shall be the promotion in the City of New York of the cause of home rule for the cities of the State by constitutional amendment, and the encouragement of the organization and co-operation of similar committees throughout the State."—[EDITOR.

[1] The writer wishes to acknowledge his great indebtedness to the scores of persons he has seen and communicated with upon this subject. If it were possible to mention them all by name, he would be glad to do so. His appreciation of their helpfulness is none the less, however.

[2] The courts of Michigan have attempted to establish in the law of that State the theory that back of the State constitution there are certain fundamental principles, which the constitution presupposes and which, although not expressly stated therein, are as binding upon the power of the legislature as the limitations in the constitution itself. In other words, the Michigan courts have held that certain restrictions are implied, and the courts of all other States have refused to recognize any limitations upon the power of the legislature unless expressly stated in the constitution. Even the later decisions in Michigan show a tendency to modify the rule laid down by Judge Cooley and others.

[1] Oberholtzer, *Home Rule for our American Cities* in the Annals of American Academy, vol. 3, p. 748-9.

the cities. A compromise measure was the natural outcome, finally adopted by fifty-three ayes to four noes.[1]

The constitution adopted by the convention was ratified by the people in the fall of 1875. Immediately thereafter a "separation scheme" and charter were drafted by a board of freeholders, submitted to the people on August 22, 1876, and adopted.[2]

Satisfactory Results Lead to Adoption in California

The charter thus adopted is generally recognized to have been far in advance of the old charter and represented in the main the most advanced thought of that day. It is now somewhat antiquated, but the working of the system under which it was adopted was immediately so satisfactory and the plan met with such widespread approval that when the California Constitutional Convention met in 1878, a proposition was immediately introduced to adopt the same plan that Missouri had tried so successfully. Conditions were very similar in the two States. San Francisco was the one large city in California (population 233,959 in 1880); the other cities were below 35,000. Special legislation had run riot. The charter, originally only thirty-one pages in length, had grown in a short time to 319 pages of fine print, and no one was able to tell what the law actually was upon a given point.[3] The State legislature had almost become the city council of San Francisco, but without any responsibility for its government and beyond the reach of local influence. The delegates to the convention from that city were insistent that some relief should be given, and as the Missouri plan was the only one which bore definite promise, based on experience, that relief would be forthcoming, they demanded its adoption.

The debate upon the proposition, which was taken verbatim from the Missouri Constitution, was very vigorous. The country members strongly opposed it; the delegates from San Francisco as strenuously urged its adoption. Members said: "This is the boldest kind of an attempt at Secession." "I am not in favor of allowing any part of this State to set up an independent empire." "Why, sir, pass that section, and the city of San Francisco . . . will occupy the same position towards the State government that the State does toward the Federal Government."[4] One member offered an amendment that ". . . such city shall thereafter be entitled . . . to receive from this State all the privileges and consideration accorded to the most favored nations, and the legislature of this State shall provide a duly accredited minister, as a representative of the State, to said city."[1]

Those who supported the plan pointed out the evils of the present system, the beneficial results in Missouri, and the groundlessness of the fear that the city would rule the State. Reference was made to the custom which had previously been general of permitting a city to call a charter convention, to draft its own charter, and to submit it to the people for their approval, and of subsequent enactment by the legislature. It was pointed out that the Missouri plan simply legalized this custom and gave the cities a constitutional right to do what had previously been found satisfactory in their own practice. Attention was also called to the fact that no charter could set aside general laws or deal with matters of other than local interest, that one of the principal objects of the call for a constitutional convention was to curtail special legislation, and that, in the language of one delegate, "if we cannot trust the people in this matter, whom can we trust?"[2]

The opposition was so strong, however, that an amendment was incorporated requiring the cities to submit their proposed charters to the legislature, which was empowered to approve or disapprove, but not to amend. Until approved by the legislature, the draft was to be without effect.

A question also arose as to whether the privilege of drafting its charter should be accorded to every city or only to cities of over 100,000 population. The latter was finally adopted. It was then argued that as the plan applied only to San Francisco, and San Francisco wanted the provision, others not directly concerned should withdraw their opposition. The smaller cities at first were anxious to have the same privileges as San Francisco, but when the provision was inserted giving the legislature a veto, they lost interest in the plan.[3]

The constitution was finally completed, submitted to the people, ratified in May, 1879, and went into effect so far as the drafting of home rule charters was concerned upon January 1, 1880.

Other States Follow

From California the idea spread to Washington, owing largely to the fact that a considerable proportion of the residents of that State had migrated from California. But in the nine years which had intervened between the adoption of the plan in California and in Washington (1889) it had shown that the submission of charters to the legislature was largely a matter of form and an unnecessary procedure. No charter up to that time had been, or indeed has since been, disapproved. Hence, Washington followed the Missouri constitution upon this point.[4]

Minnesota followed with a similar constitutional provision, ratified by a vote of 107,086 to 58,312 in 1896.[5] Colorado still more recently (in 1902) adopted the plan. The legislature of Oregon, in two successive sessions (1901 and

[1] Section 16 of Article IX of the new constitution provided that "any city having a population of more than 100,000 inhabitants may frame a charter for its own government, consistent with and subject to the Constitution and laws of this State" by electing thirteen freeholders to act as a charter convention. The proposed draft was to be prepared and deposited with the chief city magistrate within ninety days after their election. If four-sevenths of the voters ratified it at an election held within thirty days thereafter, it was to become the charter of the city and to supersede the existing charter and all amendments. The same section also provided that such charter could be amended by the law-making authorities of the city, provided three-fifths of the voters approved the proposals at a general or special election. St. Louis was specifically provided for in other sections (20 to 25 inclusive of Article IX) which, in the main, were like section 16, just summarized.

[2] The vote, as announced, was against the "separation scheme" by some 2,400 majority, and in favor of the charter by a narrow margin of 558. Charges of fraud were made against a political clique, which was reluctant to surrender its grasp upon the city and give way to good government, and the case was taken to the courts. In the case of *State ex. rel. vs. Sutton*, 3 Mo. App. 388, a decision was handed down declaring the separation scheme adopted by some 1,200 majority and the charter by over 3,000.

[3] *Debates and Proceedings of Constitutional Convention*, p. 1060.

[4] *Ibid.*, p. 1061-2.

[1] *Ibid.*, p. 1064.

[2] *Ibid*, p. 1061-3.

[3] *Ibid.*, p. 1408, 1484. The vote was eighty-nine to twenty-eight in favor of adoption.

[4] The vote was thirty-eight to twenty-four on the proposition in the convention. Oberholtzer, Annals, p. 760.

[5] Oberholtzer, *The Referendum in America*, p. 358.

1903), passed a resolution to incorporate the Missouri plan in the constitution of that State, but owing to irregularities in this procedure, it was not submitted to the people for ratification and has not legally been adopted.[1]

Initiation of Charter Schemes

Although the plans of these States are the same in purpose and fundamental principles, there is considerable difference in certain details, and to understand how they work, what are the weaknesses and defects as well as their strong points, it is necessary to examine them more closely.[2] First as to the initiation of charter-making.

The original provision in the constitution of Missouri relating to St. Louis placed the power and responsibility upon the mayor, but the amendment adopted in 1902 transferred it to the "law-making authorities," which, according to the present charter, are composed of a council and the mayor, who has the usual veto power. In the other cities of Missouri, and in California and Washington, it is now and always has been the authority which has the power to call an election for a board of freeholders, ordinarily the legislative authority—council and mayor.

The Constitution of Colorado is quite similar. In the case of Denver it ordered the election of a board to draft a new charter, and repeated elections, until one is prepared that meets the approval of a majority of the voters, if the first ones fail. But in the other cities, and thereafter in Denver, it is apparently the intention of the constitution to confer the power upon the council, but the language is vague. There is one provision which is found in no other constitution, viz.: that on petition of not less than 5 per cent. of the qualified voters, the council shall submit the question of a charter convention to the people, and if a majority vote in favor, delegates to a convention shall be elected.

Minnesota stands alone in placing the authority in the hands of the judge or judges of this district court of the district in which the city is located. If they consider that a city needs a new charter, they may appoint a board of freeholders to draft one; but as is apparent, they are not likely to do so unless the city itself wants a new charter. Provision is also made for the presentation of a petition for a new charter, and if 10 per cent. of the legal voters sign it, the judge or judges *must* appoint a board. When once the board is appointed, it may draft a new charter whenever it sees fit.

Thus in all States but Minnesota, the initiative of charter-making lies with the law-making authorities; and in Minnesota and Colorado also with a certain percentage (10 or 5) of the voters. In practice, one may say that the question is everywhere locally determined, even in Minnesota. Back of judges, councils, and mayors, stand the people, and if a considerable number of citizens demand a new charter, the proper authorities will, out of respect for this popular demand, set the legal machinery in motion. Not infrequently the preliminary work of charter-making has been done by association of private persons. The San Francisco Merchants' Association once called a convention of one hundred representative citizens. This convention drafted a charter and presented it to the board of freeholders duly elected to frame a charter. The draft had no legal status, but it aided and simplified the work of the board very greatly.

The general opinion seems to be that the proper legal authority to decide whether a convention shall be called is the law-making authority. Possibly there should also be provision for popular initiative which would compel submission to the people of the question of electing a convention, upon the petition of a certain percentage of the voters. It is questionable, however, whether it is necessary to place this provision in the constitution as long as popular bodies are so responsive to public demands as at present. So far as I can learn, there has been little difficulty in getting a convention called when there was any considerable demand for it.

Selection of Charter Board

The next step is the election by the people (in all States but Minnesota) of a board of freeholders (thirteen in Missouri, fifteen in California, Minnesota, and Washington, and twenty-one in Colorado), who shall have been qualified voters for at least five years. Two years' *residence* is sufficient in Washington, and in St. Louis there is no such restriction whatever. The object in restricting membership to freeholders was originally to secure men of established interest and ability in municipal matters, and the clause providing such qualification has been copied by State after State without much discussion. It seems to have been of little value, and there is little in theory or practice to justify its adoption by other States. The restriction as to residence or voting qualification is upon a sounder basis, but it is quite evident that these restrictions might more frequently disqualify a person otherwise well qualified, than one otherwise unfit.

The Minnesota plan—appointment of the board by the district judges—does not seem to have worked as well as election by the people, and more fault has been found with the quality of the men selected in that State than elsewhere. This agrees with experience generally, for the plan of selecting administrative or legislative officials through the judiciary has not been productive of beneficial results either as regards the judges or the men selected. In the case of charter conventions, the character of the men elected has almost uniformly been high, and there is consequently no excuse for placing a non-judicial duty upon a judicial body. Further, the fact that they are not selected by the locality tends to create distrust and arouse hostility. It is foreign to the theory of home rule.

The Minnesota plan is unlike all others also in that it makes the board permanent when once it is created. Its members were originally to be appointed for life, but in 1898 the constitution was amended, and now the term may not exceed six years. Elsewhere, the board has exhausted its powers when it has reported a charter, and if the charter is rejected by the people, it may not prepare a new draft. No compensation is fixed by the constitution, and members serve generally without pay. In three States, a time limit is set within which a charter must be reported, ninety days in

[1] Letter of Hon. F. I. Dunbar, Secretary of State, Louisiana, in 1896, provided, by statute, act 135, for a similar system of charter-making by cities.

[2] See Constitution of Missouri, Art. IX, Sec. 16-23; of California, Art. IV, Sec. 8 and 8½; of Washington, Art. XI, Sec. 10; of Minnesota, Art. IX, Sec. 36; of Colorado, Art. 20, Sec. 4-6; also ch. 238, Laws of Minnesota, 1903; Oregon Senate Joint Resolution No. 9, Twenty-first Session.

Missouri and California, and six months in Minnesota. No limit is set in Colorado, or Washington, or St. Louis.

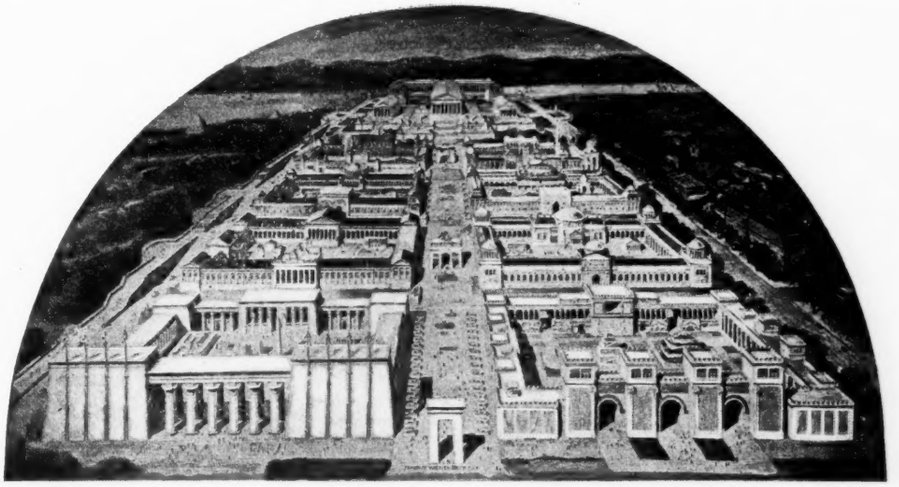
Referendum Upon Charter

Following the completion of a charter and its authentication to the proper authorities, it is duly published in the press and submitted to popular vote, sometimes at a general, and sometimes at a special, election. The number of votes necessary for ratification varies from a majority of those voting *thereon* (in California, Washington, and Colorado) to four-sevenths of all votes cast at the election (in Minnesota and Missouri—St. Louis excepted). Between these two extremes stands St. Louis, where a majority of all votes cast will ratify.

The exact wording of these provisions is important, for there may be a great difference between a majority voting *thereon* and voting *thereat*. The former is generally construed to include only the votes cast upon the charter alone, regardless of the total number cast at the election; the latter, to include all the votes cast, not only upon the charter, but for every office that may be voted for at the election. Now, as the number cast for and against a charter at a general election is very much smaller, not infrequently only one-third of the total vote, the difference between thereon and thereat is very often large, and has in several cases amounted to the difference between adoption or rejection, for a majority of four-sevenths of the vote upon the charter may fall far short of the required number when all the votes are counted. At a special election called to vote on the charter alone, there would be no such difference, and a special election is, therefore, much more favorable to the ratification of a charter than a general election.

At a special election, further, there being no other issue to absorb the voters' attention, the question of adoption or rejection of a charter is much more likely to be considered upon its merits. At a general election, only those vote upon the question, in the main, who have some special reason therefor—who find some special provision which arouses their opposition or commands their approval. Thus a small faction, moved by selfish motives, may cause the rejection of a charter which would be approved, if only the people were to consider it carefully. However, a special election is expensive.

(To be continued.)



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MUNICIPAL JOURNAL AND ENGINEER

Published Monthly by
THE MUNICIPAL JOURNAL PUBLISHING COMPANY
140 Nassau Street, New York

WILLIAM S. CRANDALL, ... Managing Editor
EMIL KUICHLING, C. E., ... Engineering Editor

JOHN B. BENNETT, ... Business Manager
E. J. BUTTENHEIM, ... Assistant Manager
JAMES H. VAN BUREN, New York, . . Eastern Representative

TERMS OF SUBSCRIPTION
(Payable in Advance)

United States and Canada . . . . . $3.00 per year
Foreign Countries . . . . . 3.00 "
Single Copies, each 25
Special rates given for clubs of ten or more.

Make all checks payable to The Municipal Journal Publishing Company

Entered at the New York Post Office as second-class matter

NEW YORK, APRIL, 1905.

Indiana's New Municipal Code

This year's General Assembly in Indiana has enacted a code of laws for the uniform government of all cities and towns in the State, thereby repealing the individual charters and incorporation acts under which the separate municipalities have been organized. The measure is expected to work many reforms in the conduct of city business. As far as it relates to cities, and in its main features, the act follows closely the charter by which the City of Indianapolis has been governed since 1895, departing from it only slightly for the smaller towns. The act goes into effect on publication by the secretary of state, which will be about May 1.

All cities and towns in Indiana are divided into five classes, according to population: cities of 100,000 inhabitants and more; cities of 45,000 and fewer than 100,000; of 20,000 and fewer than 45,000; of 10,000 and fewer than 20,000; of 10,000 and fewer. The change of ward boundaries in any city until 1907 is prohibited and thereafter, they may not be adjusted oftener than once in every six years.

The terms of all city officers is extended from two years to four years and none can be elected for more than four years in any period of eight years. City elections will be held in all municipalities on the first Tuesday following the first Monday in November, 1905, and every four years thereafter. Terms of office begin on January 1, following the election.

To be eligible, city officers, including heads of departments, must have lived in the city for at least a year preceding their election, and councilmen must live in their wards six months. Moving out of the city or the particular ward represented, vacates an office. The mayor shall fill all vacancies in elective offices, other than mayor, subject to the approval of the council. The city controller, and after him the city clerk, shall succeed to the office of mayor in case of vacancy, and after him a member of the council, designated by it, shall act until the council can elect a mayor.

No officer, employee, agent or servant of any corporation, firm, company or persons holding or operating under a franchise granted by any city or having any contract with the city, shall be eligible to office in the city. The city cannot contract with any of its employees and contracts in contravention with these provisions are void. Persons violating these provisions shall be fined not more than $1,000 and imprisoned in the State prison not less than one year, nor more than ten years.

City Councils are granted a number of powers in addition to those formerly possessed. The authority "to provide for the destruction of such substances or their use for some beneficial purpose" gives the city the right to go into the garbage destruction business. Power is conferred to license stationary engineers and "to limit the height to which buildings may be erected in the city, or in any locality or any street thereof." The power to regulate, license and tax vehicles is made general, instead of being limited to those that transport freight and carry passengers for hire. The council can also regulate, license, tax and prohibit entertainments and shows, no longer being limited to those that demand and receive money. The provisions of the "Moore law," as to excluding saloons from residence portions of the city has been included. Power is given to require railroads to light their crossing of streets with lamps such as are in use in the city elsewhere.

The salaries of all city officials under this code of laws are fixed. The mayor in cities of the first class shall receive from $4,000 to $5,000, as the council may say; second class, $3,000 to $4,000; third class, $2,000 to $2,500; fourth shall fix. The act also provides for the duties of Boards class, not more than $1,500 and fifth class, as the council of Public Works to take charge of all public improvements and city property. The Boards of Safety supervise the police and fire forces. These boards consist of three members each, not more than two belonging to the same political party. They are appointed by the mayor.

The Boards of Works have the power to condemn property for city purposes and can build sewers whenever in their opinion they are a public necessity. Property owners have the right to remonstrate, but cannot compel the board to rescind action or defeat improvements. All street pavements and sidewalks shall be made by the board subject to the will of the majority of property owners. Water works, lighting plants and other public utilities owned by any city, shall be controlled by the board of works.

Park boards of four members, non-political, shall have control of parks and parkways in cities of the first and second class. The board of works shall administer them in cities of the third and fourth class and the city council in the fifth class.

The maximum tax levy permitted for city purposes in Indianapolis is 90 cents on $100, with an additional 4 cents for track elevation purposes, if needed. Other cities can

levy as high as $1.25. Poll tax of $1.00 on each voter is also authorized. The county treasurer serves as city treasurer for cities of the first two classes, the others electing their own.

The health affairs are entrusted to a health board of three commissioners who choose a sanitarian. He acts as secretary of the board. Sanitary police are designated to make inspections under the direction of the board. They have charge of the enforcement of the pure food laws.

The city court already in operation in Indianapolis, is created for the first four classes, the mayor serving as judge in the last class. A police judge presides over the police court and can sentence all violators of city ordinances to work out their fines if they cannot pay them by labor in the streets or work house.

The act legalizes all franchises previously granted by cities and towns. As to subsequent franchises to be granted, no time limit is prescribed for them. Formerly no franchises could be granted for periods of more than ten and thirty-four years, according to kind. Cities may contract for light, water and heat for twenty-five years. Under former acts, light contracts were limited to ten years.

Extension of Municipal Ownership

At the recent meeting of the Connecticut Mayors' Association, held in Hartford, Mr. A. E. Winchester, of the South Norwalk Electric Works, read a paper on the history and present status of municipal lighting, in which he notes the rapid growth of the municipal ownership idea in the United States. In 1881, there was one city-owned electric lighting plant, and in 1904, Mr. Winchester estimates the total number at 1,000.

In the physical world, resistance is an essential to growth. The soil must be compacted to give the sprout a firm rooting. And this is a fact that seems to have been left out of the philosophy of the corporations. Wherever municipal ownership has been suggested, it has been met with antagonisms; the general proposition that in any way it would be possible for such a plant to be operated successfully has been scornfully denied; each individual proposition has been obstructed by every conceivable legal difficulty in the way of charter amendments, or lack of charter amendments, and in lobbying and vote buying; the actual results of plants in operation have been distorted and systematically misrepresented. The methods pursued by many of the companies in this warfare of interests appear to the onlooker to partake more of the character of proverbial Bourbon tactics than that of shrewd American capitalists, and on the principle that the "blood of the martyrs is the seed of the church," the companies have aided the growth of municipal ownership in a large measure.

The primary cause for this impulse of the people, which is growing in a constantly increasing ratio, to serve themselves is the universally conceded greed of the corporations, and their undisguised effort to extort the last penny possible from the public. Not that the greed of the rich man is essentially different from that of his poor brother, but it is easier to see a whale with the naked eye than a bacillus.

That the people are not content to stop with municipal lighting plants, but, having taken this first step, are determined to carry the fight into the realm of other utilities, is shown by the present mayoralty canvass in Chicago, where the one great issue is the public ownership of the surface railroads; in Kansas and Missouri, where State oil refineries are proposed, and in Nebraska, which is to have a State binder-twine manufactory.

The political principle involved in this movement is a reversal of the American theory of individualism. And the question arises, has the theory been wrong or has it become inadequate? In either case, Americans will not long cavil on technicalities, but will change their corollaries to conform to the general principle of the greatest good to the greatest number. The kingly theory that all power resided in the head of the State, which our idea of government limited, and, so far as possible, eliminated, is being rejuvenated with the people as sovereign. Its restoration could have been foretold from the foundation of the government as certainly as could be the growth of the nation.

The principle must be judged right because it is eternal, but the change from the earlier ideas of universal liberty and that the government must not interfere in private business, must be wisely conducted to avoid a natural excess, and as skilful leadership and as pure patriotism will be demanded as was required of the patriots of '76, to avoid pitfalls and disaster.

The people have clamored at the polls for "trust-busting," and some honest efforts have been made for the investigation and regulation of corporations by those in authority, but the "law's delay" has robbed the government of victory in most instances. This question of regulation now seems to be solving itself independently of politics, and by the application of municipal ownership.

Viewing this movement at short range, men of the present lack the perspective to comprehend its meaning and its magnitude. A century hence, the student of these times may class it as a revolution, orderly and bloodless, but no less important in the greatness of its results. And as the Great Charter, the English Revolution, and the Declaration of Independence were resultant from a popular reaction against a grasping tyranny, the present movement may hereafter appear similar to, and not the least among these Anglo-Saxon rebellions.

Need of Sanitary Garbage Disposal

Frenzied writers are attacking all kinds of evils, real and imaginary, at the present time, but in no direction could such talent be used to better advantage than in a campaign for the sanitary disposal of city garbage. The apathetic indifference of the public on a question upon which depends to so great an extent the health and consequent happiness of the community needs a severe jarring. The report of the State Board of Health, of Connecticut on this subject, which follows, illustrates the inexplicable shortcoming of an otherwise progressive people.

"Only two cities in the State dispose of garbage in a sanitary way by cremation, viz: Bridgeport and Waterbury.

"Although there are more than fifty cities and boroughs in the State, only a dozen report any public provision for

the systematic collection and disposal of garbage. None of these collect it oftener that twice or three times a week. Consequently in the summer the business itself becomes a public nuisance. Families usually deposit their garbage in a tightly closed receptacle awaiting the collector. During the forty-eight or seventy-two hours' interval between his calls putrefactive action begins and evolves a stench like an old-time soap factory. These small gatherings are thrown together in a common receptacle, slowly moved from house to house for new acquisitions, and when the load is full, carted to the place of final disposal.

"Is it possible to conceive of a more unscientific, unsanitary and uncivilized and disgusting practice than that followed in the two largest cities of the State for the disposal of their garbage. They and other cities, too, not only gather it as above described, but they do worse; they cart it into adjoining towns and feed this mass of rotten, semi-putrid nastiness to swine, yet both Hartford and New Haven have an educational institution of wide renown!

"As the farmer uses the family garbage it is fresh and wholesome, but putrid vegetable and animal matter cannot be considered so, except for turkey buzzards. From May to October the public collection of garbage should be made daily, especially if it is to be used as food for animals."

Larger Parks for Baltimore

THE proposed loan of $1,000,000, to be voted on by the electors of Baltimore on May 2, is reported by the press of that city to be a popular measure. This loan is for the purpose of instituting an enlarged and more comprehensive system of parks along lines suggested by Mr. Frederick Law Olmsted, and contemplates the development of new parks in every section of the city.

It is not, perhaps, especially noteworthy that a city of more than half a million inhabitants undertakes such an expenditure, but it does show a courageous self-confidence and an appreciation of the great importance of the question for a people, who have just emerged from the great financial loss that has so recently afflicted Baltimore, to unhesitatingly and even eagerly decide to spend money to this extent for a purpose which has so often been considered an extravagance.

It is an illustration of popular acceptance of the fact that fresh air and municipal beauty have come to be a necessity rather than a luxury. No longer should it be in order to regard the question of parks as one to be advocated by idealists and political grafters and opposed by conservative tax-payers, for the time has come when a comprehensive park system must be classed in any progressive community with its other necessary public utilities.

A Progressive Municipal Platform

THE Knoxville, Tenn., *Sentinel* is publishing, day by day, the planks of its "Municipal Platform," from which is quoted:

"The establishment by the city of a city park commission, and a system of taxing property in various park districts for parks in those districts."

Commenting on this plank, the *Sentinel* says: "To obtain parks, we must first have a park commission, and the council should establish one. The only system by which parks may be obtained in each section of the city is to divide the city into park districts, purchase the plans for improvement and tax the property in those districts for the parking and for the maintenance of the parks."

There is nothing more costly to the taxable property of any city than delay in instituting its park system. In a prosperous and growing city, as Knoxville, the necessary tracts can never be purchased so cheaply as at present, and procrastination in the matter will certainly mean a greatly increased expenditure. The *Sentinel* should urge this plank with the persistence of a Cato demanding the destruction of Carthage.

Another plank urges the adoption of the abutting property tax for street improvements, as the fairest system for special improvements—a statement on which there are many experienced assessors who would take issue. The question of an equitable adjustment of assessment for local improvements, as a perfect tariff bill, or the squaring of the circle, or perpetual motion seems to be an impossibility, for conditions are too varied for any general rule, and the direction of the development of a town too uncertain for reliable forecast. Approximate justice is the ultimate aim, and is, perhaps, more nearly achieved by a composite system than by adopting either the area, the frontage, or the valuation singly.

Work of the New York Municipal Art Society

ABOUT three years ago the Municipal Art Society, of New York, which had succeeded in having "isles of safety"—the first in an American city—established at several of the congested crossings in the city, offered a series of prizes for the most artistic designs for electroliers to be placed at these points. The first was erected at the intersection of Fifth avenue and Twenty-third street, and recently two more were unveiled in Times Square. The latter were designed by Henrik Wallin, and cast in bronze by the Gorham Manufacturing Company, the work of casting requiring more than six months' time. The expense, which was $5,000 each, was borne by Mr. William C. Muschenheim.

These electroliers rise from the center of the oblong substructure, guarded by low stone posts, which constitutes the "isle of safety," the base of the shaft being rectangular and surmounted by an ornamental design. Above, the shaft is cylindrical, and at the top branches into three animal heads, which support four 25 candle-power globes and one globe of 200 candle-power.

The ceremony of unveiling consisted of the presentation in behalf of the donor, by Mr. Calvin Tompkins, president of the Municipal Art Society, and the acceptance by the city by Mr. Charles W. Fornes, president of the Board of Aldermen, followed by a reception at the Hotel Astor.

These electroliers represent not merely an incident, but an achievement in the history of the Municipal Art Society, which, unlike so many æsthetic associations, is a practical and virile organization, and to which New York and her sister cities are becoming more indebted year by year for the introduction of original ideas and the adaptation of valued methods in other cities and other lands, which tend to unite the beautiful with the useful.

Personalties

—Mr. James Omberg succeeds himself as City Engineer of Memphis, Tenn.

—Mr. George I. Leland has been elected his own successor as city engineer of Lynn, Mass.

—Mr. Perry T. W. Hale is the new superintendent of the Middletown, Conn., water works.

—Mr. Robert R. Evans has been chosen for another term as city engineer of Haverhill, Mass.

—Mr. L. W. Rundlett has been reappointed commissioner of St. Paul for a term of three years.

—Mr. David N. Cook has been appointed superintendent of the Salem, Mass., Water Department.

—Mr. Robert J. Thomas has accepted a reappointment as superintendent of the Lowell, Mass., water works.

—Mr. W. O. Lumpkin, superintendent of the Electric Lighting and water plants of Alexandria, La., has resigned that position.

—Mr. Dwight H. Parsons is to be succeeded as superintendent of water works of Westfield, Mass., by Mr. Henry W. Sanderson.

—Mr. George H. Rutledge has accepted the position of superintendent of the electric lighting and water works of Concord, N. H.

—Mr. W. B. Groves, of Shreveport, La., will superintend the municipal lighting and water plants at Prescott, Ark., during the coming year.

—Mayor Born tied up the entire street railway system of Sheboygan on the failure of the company to equip their cars with fenders, as provided by law.

—Mr. O. F. Nichols recently delivered a lecture before a Brooklyn audience on the Manhattan Bridge and its approaches; the lecture was illustrated by lantern photographs. Mr. Nichols is the chief engineer of the New York City Department of Bridges.

—Mr. Francis W. Dalrymple, formerly city engineer of Jamestown, N. Y., succeeds the late Mr. Emmett Smith to that office of Bayonne, N. J. Mr. Dalrymple has his offices on the upper floor of the City Hall about settled, and will soon move his family to their new home.

—Announcement is received of the marriage of Mr. Maurice O. Eldridge, formerly acting director of the department of road inquiries of Washington, D. C., to Miss Grace Hannon Wilson, of Springfield, Ill., on March 7. The heartiest good wishes from a host of friends will be extended to Mr. and Mrs. Eldridge.

—Mr. William Barclay Parsons, of New York City, has resigned as consulting engineer to the Rapid Transit Commission of that city. Mr. Parsons was formerly the chief engineer to the commission, from which position he resigned some time ago. He has now severed his connection entirely with the Metropolitan Rapid Transit, though possibly it is but temporary.

Convention Dates

—National Municipal League will meet at New York, N. Y., April 25-28. C. R. Woodruff, secretary, Philadelphia, Pa.

May.

—American Water Works Association will meet at West Baden, Ind., May 8-12, 1905. J. M. Diven, secretary, Charleston, S. C.

October.

—American Society of Municipal Improvements will meet at Montreal, Can., some time in 1905. George W. Tillson, secretary, Municipal Building, Brooklyn, N. Y.

—The League of American Municipalities will meet at Toledo, O., in 1905. Hon. John MacVicar, secretary, Des Moines, Ia.

Successful Water-Works

THE municipal water-works system of Portland, Ore., has proven a very successful investment for the city. In 1886, the plant of the Portland Water-Works Company was purchased at a cost of $469,552, and was operated by the city without change for several years, the water being pumped from the Willamette River. The profits for the first year were over $50,000, which resulted in lowering the rates to the consumer.

The question of a better quality of water led to the installing of a gravity system, which supplies spring water of unquestioned purity, drawn from the mountains near Mount Hood, thirty miles distant from the city. The head of the system is 700 feet above the city, and the supply is 24,000,000 gallons per day, which is double the daily average per capita consumption of other cities. Space has been left beside the present conduit, in the excavations and on the trestles, for the laying of another pipe, and the city is provided with an ample supply of pure, cold water for many years to come.

The total amount of bonds issued has been $2,900,000, which have been sold at a premium of $222,200. In 1903, the cash receipts amounted to $3,936,003, while the operating expenses were $831,182, leaving a gross profit of $3,104,821. The plant is paying for itself without one cent of tax levy, and the water rates are less than one-half what they were under private control, and water for city use is without charge.

FORTY FIRES WERE CAUSED IN NASHVILLE, TENN., during the past year by defective flues; 31 by sparks falling on roof; 21 by hot ashes; 10 by lamp explosions; 24 by incendiaries; 8 by spontaneous combustion; 4 by boys and matches; 4 by rats and matches; 2 by cigarettes; 1 by cigar stump, and 1 by Christmas tree. The total number of alarms responded to was 369, and the losses were $153,862.95, the property carrying $873,995.00 insurance.

In his annual report, Chief A. A. Rozetta indicates that the department is well equipped and thoroughly efficient.

Springfield's Water Works

W. M. Ferguson

Superintendent W. H. Ferguson, of the Springfield, Ohio, water-works, handles the question of wasting of water in a vigorous and practical manner in his report for 1904. The abuse of the lawn sprinkling privilege, allowing water to rnn to prevent freezing in winter, defective plumbing and leaks in mains and services beyond the private consumer's property are the principal causes of waste.

The first two of these could be controlled by the introduction of meters, and he cites Chief Benzenberg, of Cincinnati, and Mayor Powell, of Fort Worth, Texas, the latter in the Municipal Journal and Engineer for June, 1904, to show that with a meter system waste is largely done away with resulting in a saving in the expense of pumping and maintenance, and a consequent reduction in the rates and taxes. By the use of meters the consumer pays for just what he gets, and is not taxed for the amount that his less careful neighbor wastes, and experience shows that in places where they are in service the consumers soon become the strongest advocates of the system.

The argument of Superintendent Heim, of Madison, Wis., published in the columns of this journal, advocating the payment by the city for water used for public purposes the same as by private consumers, is endorsed, as having a tendency to restrict waste in flushing streets and sewers; in fountains; in street sprinkling; in schools, etc., and in reducing the expense of operation.

Wherever the sprinkling wagons have been accustomed to tap the hydrants they are invariably found out of order and the gutters are in a sloppy and muddy condition. The erection of a curb crane is recommended to do away with this annoyance.

The extension of mains at different times has resulted in a large number of dead ends, which, by a carefully mapped plan, the superintendent seeks to eliminate so far as possible, and with a minimum expense for extensions and connections. A department workshop in the neighborhood of the standpipe is recommended as a necessity, as well as a convenience.

Other improvements of minor character are suggested in an intelligent and practical manner, indicating that Superintendent Ferguson is a man who does things.

Spokane's Water Supply

The committee appointed to investigate the present and future of the water question in Spokane, Wash., has submitted an exhaustive report.

The present consumption is found to be 223 gallons per capita, which shows a great amount of waste. The estimates of the amounts used in gallons for different purposes are: Lawn sprinkling, 6,700,000; house use, 2,700,000; street sprinkling, 300,000; reserve for fire purposes, 2,250,000; flushing sewers, 50,000; schools, 40,000; leakage in mains, 312,500; unaccounted for, 900,000; Army Post contract, 125,000. Total. 13,377,500 gallons per day. The amount used for lawn sprinkling is shown to be excessive, and a damage to the grass; the soil being very porous, the water flows through the subsoil, carrying with it much natural plant food.

The use of meters is earnestly advocated, and the experience of Milwaukee is cited in comparison with that of Cleveland. The daily per capita consumption decreased in Milwaukee with the introduction of meters from 113 gallons, in 1887, to 80 gallons, in 1901, while in Cleveland, without meters, it increased during the same period from 90 gallons to 169 gallons. That year, 1901, Cleveland began to introduce meters, and expects to reduce the per capita consumption to 100 gallons, as soon as the system is fairly established.

Spokane's committee recommend an expenditure of $340,000 to increase the capacity of the present plant.

Cement Works in Germany

The annual output of Portland cement in Germany is estimated at 5,610,000 tons. During the first year of their existence the German factories had great difficulty in holding their home trade against British competition, both on account of the cost of manufacture and because of the difficulty in convincing the consumer that it was of equal quality to the British article. It has, however, gradually displaced British cement at home and in most foreign countries and, to a certain extent, in England.

The amount exported has increased from 470,000 tons, valued at $3,000,000, in 1895, to 742,381 tons, valued at $4,530,250, in 1904, as shown by a recent report of the British Consul-General at Hamburg. The figures for 1903 show an increased export to seven countries, and those for 1904 will doubtless show similar results. Owing to the increased development of the manufacture in the United States, there has, however, been a falling off in the imports by this country, which formerly took about one-half of the German output.

For some years the German manufactories were operated on the syndicate plan, and earned dividends as high as 17 per cent. And when the profits were reduced the individual companies withdrew from the trust, and since then a period of ruinous competition has developed. The fall in price is shown in the fact that while, during the past few years, the export has increased largely, the total value has steadily decreased.

There are already immense stocks in store, estimated at over 100,000 tons, and with the continued over-production and the curtailed demand from the United States, the prospect is not bright for the German manufacturers.

Municipal Contest in Oakland

The city of Oakland, Cal., has just emerged from an exciting municipal campaign, in which the question of public ownership of the water-works system was the tug of war. The city is at present supplied by a private company, and the service is both expensive and unsatisfactory. A referendum proposition to bond the city for $5,700,000, to install a

water plant was defeated by a small majority—only about a half of the voters casting their ballots on the proposition, while the candidate for Mayor, Frank K. Mott, was elected on a platform favoring municipal betterments by a large plurality.

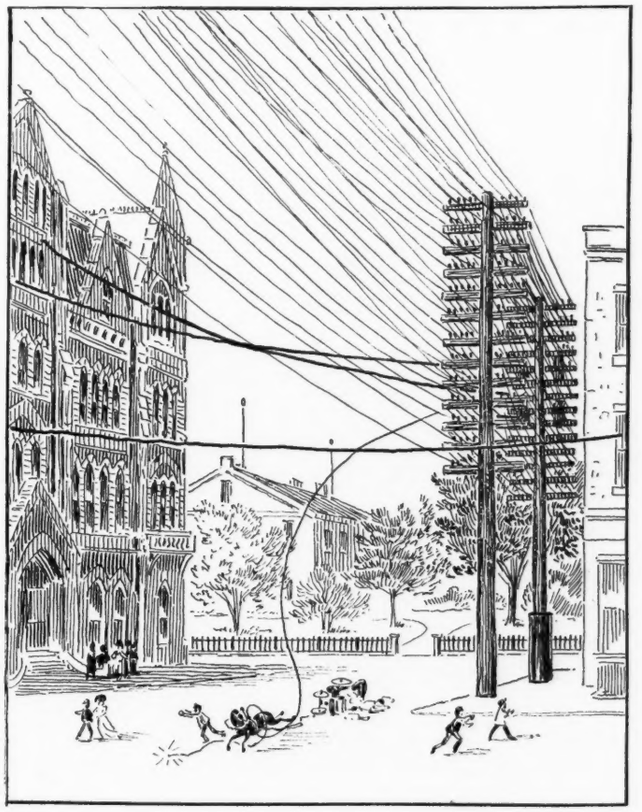
During the campaign the question of municipal ownership of water-works was threshed out most thoroughly, and it was shown that in cities owning their own plants the charges are lower, the water purer and the health rate better than in those supplied by private companies.

The question of the value of wood-stave conduits was also exhaustively analyzed, as the passage of the proposition contemplated their use, and much valuable information was collected by the local press tending to prove their service value.

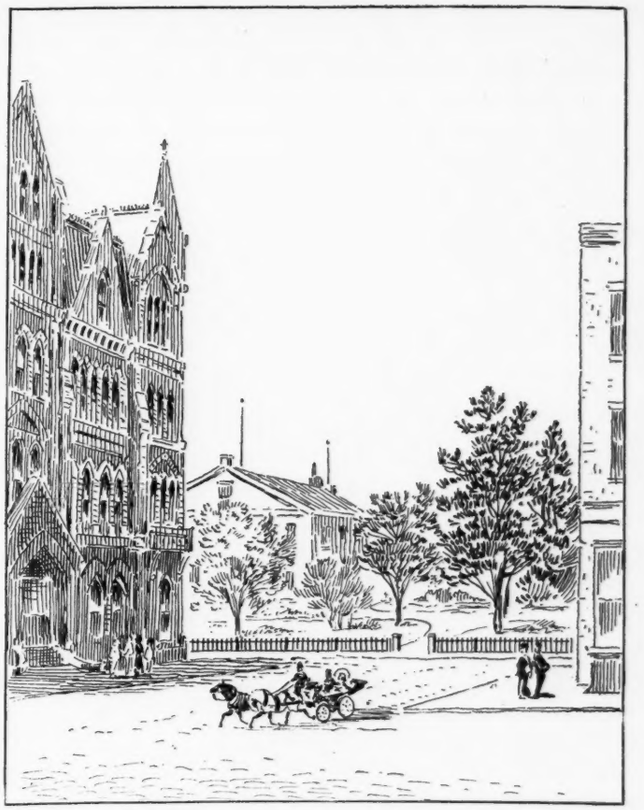
The result of the election may delay matters some, but Oakland is surely progressing toward a city water-works plant.

Benefits of Underground Wires

WIRES of the city police and fire telegraph service in Richmond, Va., are being placed underground in prescribed districts. Conduits of the Southern Bell Company have been used, by terms of contract, as far as possible and in neighborhoods where these did not extend the city has laid its own tubes. The city has laid, with an appropriation of $28,000, 24,294 feet of lead encased cables, rubber-covered copper conductors, and it is recommended that the work be farther extended. The argument in favor of such extension is illustrated in the accompanying cuts, and farther emphasized by the report of the superintendent who returns a list of 3,925 telegraph, telephone and traction poles subject to taxation.



A RICHMOND STREET CLOGGED WITH WIRES



THE SAME STREET WITH WIRES UNDERGROUND

South Norwalk's Lighting Plant

FOR twelve years, beginning with 1893, the city of South Norwalk, Conn., has been operating a municipal electric lighting plant. During this period the adjoining city of Norwalk has been paying a private company at a rate of $74 per year per arc street lamp—which is $9.71 less than the average for all the cities of the State—and a comparison shows that the tax-payers of South Norwalk have saved $18,425 over Norwalk, and $30,128 from the average of the State, by owning its own plant.

In 1898, commercial service was added to the plant, and is proving profitable to the city and the consumer alike. The total cost of the additions to the plant to supply private customers has been $44,000, and the receipts from the source during the past year alone have been $20,096. The cost to consumers is for 16 c. p. lamps from $.005¾ for one lamp to $.0041 for 200 lamps per lamp hour; for commercial arcs from .049 for one lamp to 0.039 for five lamps per lamp hour, and for power, from $.0331 per single horse-power per hour to $.019 for 50 horse-power per hour.

The past year shows an increase of 75 patrons, of which 59 were for light and 16 for power, and a total of 1,270 lamps of 16 c. p. have been added to the system. The net profits for the year have been over $6,000.

The people of the city are just awakening to the possibilities of the cheapness of light and power at their disposal, and the prospect is for the immediate installation of an enlarged plant.

Method of Recording Local Improvements

An inspector's record of local improvements, keeping in a convenient and permanent form all the data regarding laterals, water mains, surface sewers, Y branches and hydrant drips with respect to each lot, is illustrated in the acompancying specimen page from the book supplied the inspectors in Rochester, N. Y.

Location of Lot Laterals, Water Services, Surface Sewers, Y Branches and Hyd't Drips.

Rochester, N Y. May 27th 1899.

Street Number of House ——— side of street West
Name of Owner M. E. Briggs.
Number of lot as per Map 14
Name of Foreman on work J. Colnon.
Was lot lateral put in? Yes size 6 inch
Was Y branch put in ——— size ———
Was lateral connected at curb or main sewer? Main
If at main, what depth is old lateral? ———
Depth of Main sewer 9 feet
Depth of lateral at curb line 6 feet 8 inches.
Distance from South line of lot to lateral 19 feet
Distance from center of manhole North of lot to lateral 196'
Was water service put in Yes size 1½"
Distance from South line of lot to curb box 20'-6"
Depth of water service at curb 4 feet 6 inches.
Distance from center of manhole North of lot to water service 106'-8"
Is there a surface sewer near this lot? Yes
Is hydrant in front of this lot? No
Was drip put in? No
Depth from surface of street to rock 4 feet ——— ins
Character of soil: Gravel, ~~Loam, Quicksand, Boulders, Hard Pan.~~

(Inspector will cross out name of material NOT found.)

Signed B. F. Bryant
Inspector.

Miscellaneous Work.

Is there a building on this lot? No
If so, give House Number ———
What is building used for ———
Was new walk laid? Yes width 5' length 110'
material Portland Cement
Was walk relaid ——— width ——— length ———
material ———
Time spent in relaying walk ———
Was any other special work done in front of this lot? No.
If so, give details. Make drawing of any special work here:

SPECIMEN PAGE FROM BOOK KEPT BY INSPECTOR ON LOCAL IMPROVEMENTS.

Municipal Gas and Electric Lighting

The second year of operation of the Holyoke, Mass., municipal gas and electric plant has proven very satisfactory to the public. Manager Snow, in his annual exhibit, shows that in spite of extensive repairs, amounting to a thorough overhauling of the plant and a large reduction in the price of gas sold, that there remains a substantial surplus to the credit of the department.

Both plants were in need of extensive repairs when the city took them, and the great burden of this expense has been meet during the past year, making an apparently excessive charge for this item. At the gas works, two benches of retorts have been rebuilt; the floor to the retort house has been relaid; the water gas apparatus relined; fittings on it replaced; roofs repaired; a new wash-room, with lockers, shower bath and closets, has been built; a new drum put into the station meter, doubling its capacity, and other minor improvements have been made. The street mains have been overhauled for leaks; 8,357 feet of pipe have been laid and 629 new meters have been set.

The output of gas for the year was 115,103,394 cubic feet; 7,790 tons of coal were carbonized; 287,640 bushels of coke were made, of which 111,234 bushels were sold; 99,875 gallons of tar were manufactured, of which 53,780 gallons were sold; 187,652 gallons of gas oil and 172,981 bushels of coke were used in the manufacture of gas.

There is a total of 5,145 meters in use in the city, and 38.08 miles of mains, being an increase for the year of 13.9 per cent. in the number of meters and an increased mileage of mains of 3.9 per cent. The average daily output of gas has been 466,300 cubic feet, with a maximum of 527,500 cubic feet, and with a storage capacity of less than 250,000 cubic feet. Manager Snow strongly urges the immediate construction of greater storage capacity as protection against possible accident, which might leave the city without gas.

On May 1st, the net price to the consumer of gas was made $1.20 per 1,000 cubic feet—a reduction of 15 cents—which diminished the receipts at the rate of $15,000 per year, and for four months they were less than for the corresponding months of the pear previous, but since then they have shown an increase due to greater consumption. The sales of tar have also fallen off, owing to the condition of the market.

In the electric plant there are now installed two 350-kilowatt generators, and a third of 450 kilowatts is about ready for service. A turbine generator set for 500-kilowatt capacity will be in operation by May 1st. When all the proposed apparatus is installed the station will be capable of delivering 2,200 horse-power, with water and steam combined. The present demand is about 1,200 horse-power, with an addition of 300 in the immediate future, so the increased power, while being sufficient for the requirements for some time to come, was a necessity.

There are set 2,195 poles, carrying 131 miles of main wires, an increase of 82 per cent. in the wire mileage since the plant was taken over. The total number of customers is 366, of whom 43 are supplied with power. There are 493 street arc lamps, 237 commercial arcs, 15 incandescents of 30 c. p., and 24 of 16 c. p. The net price of electricity is 10 cents per kilowatt hour.

The cost of operating and maintenance of the gas plant for the year, including charges for depreciation, interest and repairs, has been $134,942.30, and the income $144,903.19, giving a net profit of $9,960.89. And the cost of the electric plant similarly shows an income of $95,309.61, with expense amounting to $84,142.39, leaving a profit of $11,167.23.

An Improved Ash Cart

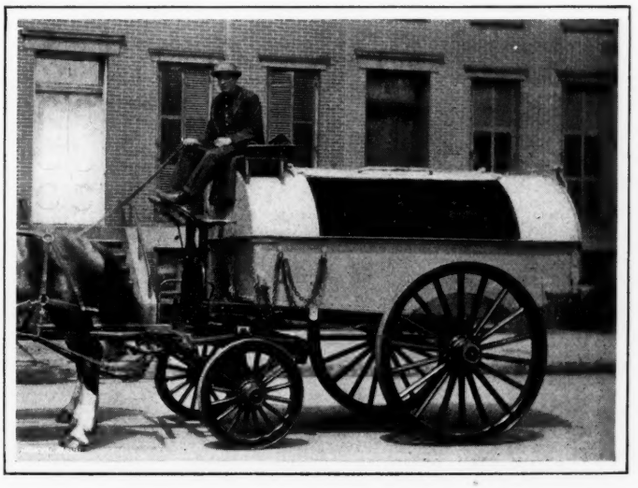
COMMISSIONER JOHN MCGAW WOODBURY, of the Street Cleaning Department of New York, has recently installed a new cart invented by Mr. Thomas Hill, of Jersey City, for the

THE IMPROVED ASH CART—CLOSED

house to house collection of ashes, which will, it is believed, do away with the dust nuisance that is so disagreeable under the present system. Sixty-two of these carts will be placed in commission on the streets of New York by the first of April, and their advent will be hailed by the residents as a relief and a great improvement in the service.

The commissioner, though a strenously busy man, has been considering improved methods for several years, and the possibility of securing the contents of ash cans throughout the city, without having the wind, even when light, scatter the finer portion over the streets and the house-fronts and sprinkle the passers-by with dust. Many different methors have been suggested and vetoed as impracticable, but now a solution of the problem seems to have been reached, and Mr. Woodbury is satisfied that with the new cart the dust trouble will be reduced to a minimum.

" These carts," he says, " are being completed, and the new style of cover is a success; for in dumping it rolls back like the cover of a desk and leaves the cart as open as those carts we see every day on the streets. The carts are a little different in shape—perhaps a little better to look at—but otherwise are just the same as those we see now."

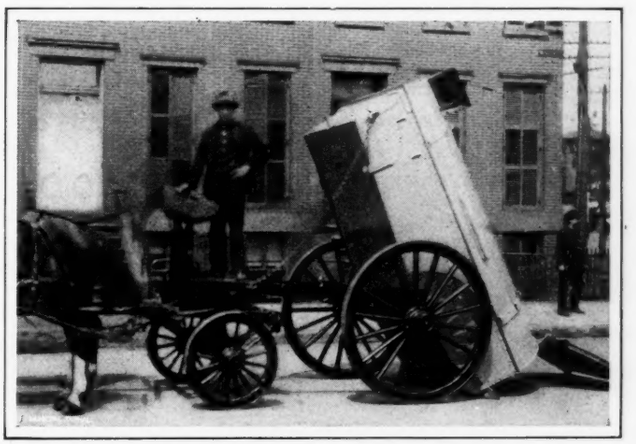


THE CART WITH THE COVER ROLLED BACK READY TO RECEIVE ASHES

The body of the cart is of sheet metal, which permits of easy and thorough cleansing, making the only sanitary material for the construction of wagons which have to carry more or less refuse. And in general appearance, it is similar to those now in use, except that it is covered with a barrel shaped top, which is fitted permanently to the box. In the side of this cylindrical cover are slides made to roll up in much the same way as a roller-top desk opens, and which are kept tightly closed save when the cans are being dumped into the cart. Instead of the shovel-shaped rear end, the new cart will have a swinging end board, which can be released at the bottom for the purpose of dumping the cart.

The carriage will have four wheels of the heavy truck style in place of two on the carts now in use, and the body will be arranged with the familiar device for sliding it back far enough to allow it to tip down and dump.

It is designed to be drawn by two horses, though its weight is not greatly in excess of the single horse carts, and its capacity is about the same, holding approximately 1½ cubic yards.



SHOWING HOW EASY THE CART IS DUMPED

The builder is Mr. Thomas Hill, of Jersey City, and the carts are being constructed at Sing Sing, N. Y. The cost of each cart of the style and capacity ordered for New York is $375.

So simple is the contrivance and so thoroughly practical in its operation, that it is safe to predict that public sentiment will demand that all the old carts be replaced by this new invention.

THE EXPENDITURES FOR SEWERS BY NEW BRITAIN, CONN., for 1903-4, were $117,522.96, one of the largest amounts for any year in the history of the department. This large expense is due to the building of trunk sewers and the installation of filter beds. A large amount of work remains to be done to change the present combined system to the separate system.

Good Roads in California

CALIFORNIA has expended during the past two years—the legislature meets biennially, and appropriations are made for two years—$40,285 through the State Department for Highways, and $4,310,921 through the counties on its 45,000 miles of roads.

The application of oil, which has been extensively used throughout the State, has proven of benefit so far as it goes, but it is not all-sufficient in the making of good roads, and there is a growing demand that this branch of the public service be placed on a more practical and systematic basis.

The problem that confronts the people is how the greatest benefit may be derived from this liberal expenditure of money, and the State Highway Commissioner, Mr. N. Ellery, suggests that the system of State aid and State supervision in use in some of the Eastern States be adopted.

He specifically mentions the New York State procedure that provides that when the owners of two-thirds of the lineal feet fronting the roadway in any district petition, and the Highway Commissioner approves, after taking into consideration the use, location and value of such highway or section thereof for the purpose of common traffic and travel, that it shall be improved with Telford, macadam, gravel or other suitable construction, the commissioner to specify which, after taking into account the climate, soil and the materials to be had in the vicinity and the nature of traffic likely to be on the highway. The width of the improvement shall be not less than eight nor more than 16 feet, and the cost shall be paid, two-fifths by the State, two-fifths by the county and one-fifth apportioned on the property benefited.

Mr. Ellery finds the same sentiment in his State which is prevalent throughout the country, viz: That the country roads are merely feeders to the railroads, and their improvement a matter of local interest only. Before the era of steam there was an effort, restricted by the lack of funds and the thin and scattered character of the rural population, for State sustained trunk highways, which the advent of railroads rendered less necessary. The growth of the country has, however, brought the question again to the front, and the enormous development of the farming industry makes the matter of good roads an economic necessity.

California roads require a wide variety of treatment from the oiling, so successful in subduing the dust in the valleys, to blasting through rocks and bridging mountain gorges.

The commissioner has made an exhaustive examination of the mountain roads, and finds much improvement necessary and possible in the way of reducing grades and widening roadways or introducing turnouts, and, as usual, much of the work done under local supervision is worse than valueless. There are counties whose valuation will not permit of any extended road work, with prosperous adjoining counties hampered by the reason of this poverty.

The portion of the State north of the center had received almost the entire attention of the commissioner during his biennial term. A wagon road to Lake Tahoe, on the Nevada line, and the two county roads, Sonora-Mono and Trinity-Humboldt; the Mono Basin, and the survey of the Eel River road comprise a total of more than 200 miles built and projected. The last presents a most difficult problem. The Eel River Valley is 18 miles in length and four in width, and is very fertile; the stream becomes, at times of heavy precipitation, a torrent, changing its bed or overflowing its banks; "it built the valley and now seeks to destroy it." An extensive system of riprap work is the commissioner's solution.

The Yosemite roads are in poor condition, and not likely to receive State attention at present. The legislature is considering a measure by which the State park may be transferred to the National Government, and the State be thus relieved of the burden. The State park, established in 1864, comprises 36,000 acres, and partly surrounding it is the United States park, reserved in 1890, containing almost 1,000,000 acres. By the Government assuming control, it is believed that the two could be more carefully preserved and more symmetrically developed than under dual ownership.

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Chicago's Municipal Campaign

THE mayoralty contest now on between John M. Harlan and Judge E. F. Dunne, of Chicago, is a struggle over the question of municipal ownership of the street car lines of the city. Eight years ago Mr. Harlan ran on an independent ticket for the office of Mayor and a platform that declared the streets to be the property of the people and with which they might do as they wished. Though then regarded as ultra radical he polled more than 70,000 votes. Now he is out-Heroded in his radicalism by his opponent. Mr. Harlan is still in favor of municipal control, but would approach the problem with some regard to the power of the city to pay, and would, when the cost of the investment is determined, submit the proposition by referendum to the people to decide whether they will immediately assume the burden, or will undertake it by degrees. His opponent proposes to assume that his election will be a popular endorsement of a policy for expending $80,000,000 on the traction properties, and will at once buy the several roads, or commence condemnation proceedings to acquire a title. Which of the two candidates is successful, it seems that Chicago is destined soon or late to have municipal street cars.

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Municipal Lighting for Knoxville

THE committee appointed to investigate the advisability of a municipal electric lighting plant for Knoxville, Tenn., recommends that the city build and operate its own plant and have it ready by July 1, 1905, at which time the present contract expires.

Overhead wires are recommended, as less expensive, and the expense of the plant is very carefully estimated at $137,900 for a service of 500 arc lamps of 2,000 c. p., for 4,000 hours, and 2,000 16 c. p. incandescents. The cost of operation, including salaries, repairs, insurance, interest, depreciation and maintenance, is placed at $24,752.75, or at an equivalent of $49.23 per arc lamp per year as against $80 on the present contract.

The committee estimates further that the city will be able to sell sufficient light and power from the proposed plant to produce an income of $52,400 per year, which will

pay the cost of the public lighting and leave a substantial profit.

Conditions in all cities having municipal plants have been exhaustively examined by the committee, and its calculations have been based on a maximum of cost and a minimum of results.

A bill will be introduced into the State legislature to authorize the city to build and operate its own plant, and granting it the power to sell electric current to private consumers for light, power and heat, and also enabling it to condemn land for the site and use of such plant.

Value of Municipal Advertising

"MUNICIPAL ADVERTISING" was the subject assigned to Mr. Elliott H. Pendleton, editor of the *Citizens' Bulletin*, for an address at the recent annual banquet of the Cincinnati Industrial Bureau.

The first duty of the Industrial Bureau or any Board of Trade, as defined by Mr. Pendleton, is to advance in every way possible the prosperity of every one already identified with the city. Make home so pleasant and attractive that none will care to leave, and all will speak of it optimistically. No business concern should be permitted to remove from the city, without the Industrial Bureau asserting the reason therefor, and if it is as the result of inducements offered in the line of bonuses, the speaker advises that a record be kept of the experience of the concern in its new location.

Advertising is recommended along such lines as write-up by the local press of the aims and purposes of the bureau; its readiness to serve in the matter of giving information and securing sites for prospective settlers. Hotels should be used to assist in efforts to reach their guests, and railroads in giving publicity by placing the literature of the bureau in their folders. Leaflets and souvenir pamphlets are commended as good, and a publicity department is suggested. Spasmodic advertising should be avoided, "it is the constant hammering that is bound to make an impression."

In closing, the speaker said: "I wish to quote from an article that is instructive.

"Before any results follow, the prospective investor will come to town and look over the situation personally. Right here is the crucial test. If he is met with a band at the depot, dined at the principal hotel, driven about the city in carriages, feted at clubs, and otherwise made to feel at home, you have appealed to the social and possibly the poetic side of his nature, but if he is a wise business man (and you don't want to attract any other kind) his time is valuable. Let him meet the Mayor, and the Hon. Judge Spoopendyke, and Representative Blunderbuss, if necessary; but be sure to have some fellow in the crowd who can take him quietly to one side and point out the volume and fall of the water-power, lay out a map before him and explain the shipping facilities and connections, show him some vacant land available for a factory site, and how easily a spur can be run into the factory.

"Don't mix the man up with a banquet, but get him out in some social gathering in the evening in an informal way, where he can get a glimpse of the social side of your town. Make him think that you want him and that he wants you. Get him into the notion that he is going to have the hearty co-operation and support of good citizens, that the town will take an interest in his affairs and help in every legitimate way to promote his welfare. These facts will make more impression on him than the free gift of a factory site or any other of the catch-penny schemes which have hitherto been presented for his acceptance.

"He is just a human man. He wants to make money, live in a good community, surrounded by cheerful, optimistic people, and it is your business, as an Industrial Bureau, to set these facts before him in the best possible light."

Trolley Line in Hong Kong

HONG KONG, CHINA, has installed a trolley line, and ricksha, drawn by a Chinese coolie, which has done service as rapid transit for tens of centuries, is doomed. The total length of single track is 14½ miles, laid on a route 9¼ miles long, and running parallel to the sea. Except for a short distance, no grading was required, but owing to the nature of the ground, sections of which had recently been reclaimed from the sea, care was taken to reinforce with a bed of concrete.

The track gauge is 3½ feet, and the overhead construction is supported on steel poles with ornamental base castings. The trolley wire is divided into half-mile sections by means of section insulators, and at each of these sections the main feeder current is tapped. The equipment consists of 26 motor cars, 10 of which are of the combination type, the remainder being of the open cross-bench style.

The generating station is situated near the center of the system, and on the Bowrington Canal, from which water is drawn, and coal is easily delivered from barges. Over 5,000 piles, from 15 to 18 feet in length, were driven as a foundation for the station. The greatest difficulty encountered in construction was connected with the chimney, which is 153 feet in height, and must withstand typhoons of great severity, and, too, it was a class of work entirely new to Chinese masons.

Cost of Tennessee's Highways

COL. J. B. KILLEBREW gives some figures in the *Nashville American* on the cost of public highways that are full of interest. He shows that the road tax for the several counties of the State ranges from 5 to 16 cents per $100 of assessed value, or, to specify accurately, two counties have a 5c. rate; four counties, an 8c. rate; sixty-two counties, a 10c. rate; 19 counties, a 12c. rate; two counties, a 14c. rate; two counties, a 15c. rate, and five counties, a 16c. rate. The grand total of tax for these ninety-six counties is $364,762.92. The number of men subject to road tax is 217,511, who are employed from five to eight days each year. The total amount expended for labor on highways is $931,049.82—labor being commuted at 75 cents per diem. The total amount expended in money and labor is $1,295,813.14.

From these figures Col. Killebrew estimates that sufficient money is expended each year to pay the interest, at 4 per cent., on bonds to raise enough money to build from four to six macadam roads for each county seat to the outer boundaries of the county and have enough left to create a sinking fund to retire the bonds in thirty years. He recommends a general State law to permit counties to issue bonds for highway building without special legislative enactment.

INCIDENTAL ITEMS OF INTEREST

Many Matters of Moment to Municipalities Briefly Told—Short Record of Happenings and Facts in City, Town and Village

THE COST OF MACADAMIZING STREETS in Harford, Conn., for the year 1903, amounted to $35,351.53, and the total number of square yards covered was 53,400. On streets where the stone used was taken from the city quarry the cost per square yard ranged from 38.3 cents to $1.715. The cost of quarrying per cubic yard was $0.6244; crushing, $0.169; carting to breaker, $0.236, and the average cost per cubic yard delivered on the street was $1.619, while the cost of stone purchased was $1.33.

VITAL STATISTICS OF EIGHT LEADING CONNECTICUT CITIES show the following diseases to be the most fatal, and in order named: Consumption, pneumonia, infantile diarrhœa, Bright's disease, apoplexy, cancer, grippe, diphtheria and croup, typhoid fever, whooping cough, scarlet fever and measles. The average annual death rate per 1,000 inhabitants for the past ten years have been almost identical in these eight cities, and varies from 14.03 in Meriden to 17.54 in Waterbury, with an average of 16.03.

PAVEMENTS IN NEWARK.—E. Adam, City Engineer, Newark, N. J., in a report made to the Board of Street and Water Commissioners, shows the city has 149 miles of pavement, as follows: Creo-resinate wood block, .075 miles; bitulithic, 1.94 miles; cobble stones, 9.36 miles; brick, 11.556 miles; Belgian block, 12.215 miles; Telford, 14.335 miles; granite block, 48.775 miles; sheet asphalt, 51.095 miles. These have cost to date, $7,200,000. This does not include 8.61 miles Telford pavement within city maintained by the county. There are one hundred miles of streets in the city yet to do. The fund in hand for paving in 1905 is $400,000. He suggests in closing that more liberty be given the commissioners as to streets to be paved and material used, to avoid disharmony among property owners.

GUS HANNA, SUPERINTENDENT OF STREET CLEANING, in Cleveland, Ohio, in his report for 1904, shows the total expenditure of that department to have been $147,785.41. There were hauled off the streets 43,646 loads of sweepings and 8,022 loads of snow, and 59,000 squares, of 10,000 square feet to a square, were cleaned by machines at an expenditure of $64,337.12, and the white wings system cost $35,340.56. The prospect of the new machines for the season of 1905 leads to the prophecy that the dust problem, especially on the street railway lines, will be very nearly solved.

Mr. Hanna recommends the rigid enforcement of the ordinance governing the transportation of refuse through streets by the city, and the nuisance of lunch wagons, curb merchants and fakirs, especially at holiday times. That the city undertake the collection of house refuse and ashes, and that street sprinkling by private contract be entirely done away with.

THE CITY OF CENTRAL FALLS, R. I., has an estimated population of 20,000; the area of the city is 1.27 square miles. The length of streets is 24.6 miles, of which 1.2 miles are granite paved; 6.8 miles are macadam, and 8.1 miles are gravel. There are 17.6 miles of water mains; 11.2 miles of sewers, and 3.17 miles of street railway. The total debt is $400,312; the total expenses for the year 1904 were $245,042, of which $123,130 was issued by tax.

THE BOROUGH OF ST. PANCRAS, LONDON, ENGLAND, has, in connection with its Health Department, a "personal cleansing" station, for the treatment of persons who are affected with verminous or parasitic disease. The patients are treated with hot baths, and their clothing is sterilized in a steam disinfecting apparatus adjoining the baths. During the nine months of 1904, in which the station has been in operation, 952 males, 514 females and 332 children under 10 years of age have been treated—a total of 1,798. A large portion have been school children, sent by their teachers, the number being greater than the figures indicate, as children between the ages of 10 and 14 are classed for convenience as adults.

CHICOPEE, MASS., WAS INCORPORATED as a city fifteen years ago, since which time it has installed an extensive water works and sewerage system, established a permanent fire department with buildings and equipment, built school houses and erected an electric light and power plant. The debt of the city is $603,900, and the municipal assets are more than two and one-half times that amount.

Mayor Taylor, in his inaugural address, shows that the city water-works and the lighting plant are in good financial condition, and that the other departments are thoroughly efficient, and, while recommending some necessary expenditures, he urges economy until the interest-bearing debt can be reduced.

THE USE OF ACETYLENE GAS is rapidly increasing in towns where other means of public lighting are found too expensive.

In 1898, it was introduced into four towns; the number was doubled for 1899, and more than doubled again for 1900, and has kept on in this arithmetical progression until it now exceeds 200. Germany has more than 60 acetylene town lighting plants, France 90, and Great Britain 16, and it has found its way into other countries of Europe, South America and to Australia.

The ratio of acetylene to ordinary illuminating gas is about one to ten of bulk to produce a given light, the remaining nine-tenths of common gas being composed of detrimental elements, which take up storage room and impair the quality of the light. Plants are readily operated, and but little labor is required. The selling cost ranges from $1.25 to $1.50 per hundred, which places it on about a level with ordinary gases.

SUGGESTIONS TO UNDERWRITERS*

A Practical Engineer Concludes That Buildings Can Be Made Fireproof—Lessons of the Baltimore Fire—Structural Features to Be Avoided

By John R. Freeman†

I WAS very much interested in the efficiency of the plain steel-plate shutters on the inside of the windows in the Safe Deposit and Trust Company building. These kept the fire out very successfully, notwithstanding that the large non-fireproof building of the *Baltimore Sun,* which was entirely wrecked, and was one of the hottest parts of the entire conflagration, was only ten feet away. The damage was so imminent that the police ordered the men to leave the Safe Deposit building and the heat melted the lead sash-weights within the cast-iron window-casings, destroyed the sash and glass, and chipped the brick walls, but the damage on the interior of the building was almost nothing. These steel-plate shutters were so set that they were free to expand, and they were free from ribs, and of a form not likely to warp much, and they did in fact warp but little, and the casing and jamb were of such form that this warping of the shutter off its seat did not open a wide crack, and there was no combustible material near them on the inside to receive their radiant heat.

Capt. Sewell, if I understood his remarks aright, suggested a steel shutter stiffened by ribs.

Ribs are dangerous unless very carefully designed, and attached, and, as generally applied, increase the liability to warp.

I happen to have been an eye-witness of the fire twenty or twenty-five years ago that gave to the tin-clad shutter its great start on the road to popularity. This fire was in the Pacific Mills, at Lawrence, Mass. In that case there was a tin-clad wooden fire-door, of what has since become standard construction, standing immediately beside a steel-plate shutter that was heavily ribbed on the edges. Apparently it was a fair comparative test for the two shutters. The ribbed steel shutter warped away from its bearings two inches or three inches, as I now remember it, in a way that let the fire play freely around its edges, while the tin-clad wooden shutter remained in place without warping and was in good working order when the fire was over, the tin covering intact and the wood charred only about half an inch deep. These results were published far and wide, and this gave the first great impetus to tin-clad shutters.

There have since been hundreds of demonstrations of the endurance of tin-clad shutters in fires, and I have taken advantage of many opportunities to examine carefully into the conditions under which they have been exposed. The result of these examinations has been to convince me that the endurance of the tin-clad shutter is limited; that its limit of endurance is often passed; that for severe cases we do need something better than the ordinary underwriters' tin-laid wooden shutters, and that we do need something very much better than the ribbed steel shutter or the rolling jointed steel shutter.

At present the best we can do in any important case is to use two fire-shutters or fire-doors, one outside and another inside; one will receive the brunt of the onslaught, and perhaps in the course of half an hour warp or break down; the second, shielded behind the first, will stand up to its work until any ordinary fire is over.

It seems to me that the main reason why those steel shutters in Baltimore, at the building which I have just mentioned, performed so well was that they were free from ribs, and thus became heated more uniformly, with but very slight warping; that they happened to be so fastened to a frame that they were free to expand, and their seat happened to be of such a shape that, although the shutter did warp a little, this did not open much of a crack, and that there was no combustible material close to them on the inside.

The path of safety from exposure-fires for office-buildings and the like, lies in a window casing formed so that we can attach to it a shutter of a form similar to the ordinary inside house-blind. Our ordinary business buildings have walls thick enough, so that by making the shutter in four folds, or leaves, two being hinged together, and these two in turn attached to the wall, making each fold in the shutter only about fifteen inches wide, the window will be wide enough for all practical purposes, and we can fold the shutter back within the window jamb, very much as we do the inside blind.

To do that with the present ordinary tin-clad shutter would be almost impossible, because of the thickness of that form of shutter. It can be done with a steel-plate shutter without ribs, and the radiation from the inside can be checked by some thin incombustible porous covering like asbestos board. If in our underwriters' laboratories, in our technical schools, and in our tours of survey we can direct attention to these views and urge the solution of the problem of how to make an efficient fire-shutter which shall only be three-quarters of an inch or an inch in thickness, I believe that before long the problem of protecting an office-building against exposure-fires will be found solved.

It is entirely possible to design a window opening adapted

*The first part of this article appeared in the March number.—[EDITOR.

† Consulting Engineer, Providence, R. I. An address delivered at the Annual Banquet of the National Board of Fire Underwriters at Delmonico's, New York.

to receive a safe shutter, so that it will be just as convenient for ordinary business purposes as the type now common. I think it probable that the best place for the shutters is *inside the glass,* sacrificing the glazed sash outside them in case of any great conflagration.

"Water Curtains" and "Wire-glass"

We hear a good deal nowadays about "water curtains," and I would like to say just a word on that, because I think there is a great deal of misapprehension about their efficiency. I would like to say a word about wire-glass also, because although in general excellent, I think there is a great misapprehension as to what wire-glass can do.

I began experimenting with wire-glass very soon after it first came out, and I have used it in numerous instances, and it is a most excellent material in its way, but it has its limitations; it has the same limitations that a water curtain has, and that is, that it does not stop the passage of radiant heat.

You all have noticed how, when you are traveling in a railway train, perhaps at sixty miles an hour, and they happen to be burning a pile of ties along the track, that although your face is directed toward your newspaper, you will feel the flash of heat passing through the car window and striking against your face as you go past that pile of burning ties. That simply illustrates the great ease and rapidity with which radiant heat passes through glass.

Now, radiant heat passes through glass with wire netting in it almost as easily as it does through any other glass, and the record made by wire-glass in a certain building in Baltimore, which is pointed to with so much pride, is, I think, simply due to the fact that it was at a place where nothing combustible was immediately behind it. If you have a stock of dry goods, or wooden ware, or baled cotton or hemp just inside a wire-glass window without shutters, and there is a hot fire across the street, these can probably be set on fire with much promptness by the radiant heat passing through the glass, and the subject should be thoroughly studied on a large scale in our underwriters' laboratories. For safety, there must be something which will stop the radiant heat, and that can only be in the form of a shutter, and, by virtue of stopping the heat, the shutter will become hot.

The case with the water curtain is very much the same as with the glass. Water is diathermanous, as physicists call it—that is, radiant heat passes through water very easily.

We must, I believe, set down these stories that have been told about the efficiency of water curtains as being mainly fairy tales.

This supposed efficiency of the water curtain is another topic which I hope that some one of our underwriters' laboratories and some of our schools of applied science will take up and investigate with precision of measurement.

I have heard stories of the wonderful efficiency of the water curtain, but I must beg to disbelieve them, largely on theoretical grounds as yet. It is a matter which can be tested very easily.

The window sprinkler came in for a good deal of praise in certain quarters of Baltimore. I took particular pains to investigate that, because I wanted to find just how far they merited it, and I have no doubt they did some good, but they are not entitled to anything like the glory that is claimed for them. They will tell you a great deal about the remarkable work done by the window sprinklers in the Toronto fire. Now, I sent a bright young engineer up there especially to investigate that question and to go into it in detail, and to take photographs of the individual windows and to get right down to the bed-rock facts, and, from the mass of evidence that he brings back, I do not doubt that they did some good; but *the inside ordinary much more good.*

In short, if you want to provide against an exposure-fire, I believe that the only way to do it is:

First, by a wall either of brick or cement concrete.

Second, by properly designed window openings and window casings; and

Third, by good shutters in those windows.

In the absence of shutters, automatic sprinklers, supplemented by heroic efforts with hose streams on the inside, may sometimes save the day, with great expense for water damage; but where exposures are bad, a good shutter on a proper window should be the first care of architect and owner.

Fire Resistance and Plaster of Parls Compounds

I have a word to say about "limotile" (lime of teil) and about plaster of Paris or gypsum mortar for interior finish. In going from room to room in the different buildings in Baltimore, it was very noticeable how completely plastering, of which gypsum or plaster of Paris was the base, had peeled off. The complete failure of "limotile" was also very interesting. I brought back some samples of the "limotile" from the Equitable building and from the *Herald* building for analysis and fire test. It was found that this "limotile" was about 33 per cent. plaster of Paris and the remainder apparently coal ashes, with perhaps some sand. Plaster of Paris gives off its water of combination under a heat slightly below 500 degrees Fahrenheit. That is a very moderate temperature for a fire, and away below the temperature found in most rooms that are well on fire.

Anything that will go to pieces at 500 degrees temperature is unworthy of being classed as a fire-retarding material.

The resistance to heat offered by plaster of Paris compounds used as mortars is a most fruitful topic for study in our laboratories.

I was particularly struck by the weakness of the "limotile" partitions in the Equitable building, and if anyone will go through the Equitable building and see how thoroughly those "limotile" partitions failed, how the "limotile" ceiling failed, they will have such an ample practical demonstration that, in their case, no laboratory test will be needed as to the folly of depending on any material for fireproofing which is largely composed of plaster of Paris.

Fire Resistance of Portland Cement

The behavior of Portland-cement compounds was in marked contrast to the plaster of Paris compounds.

We are just now entering upon what in engineering may be termed the Portland Cement Age. It is remarkable that in all these years we have been using this material, it is only within the past five or ten years that we have begun to duly appreciate its real possibilities.

After studying the Baltimore ruins, I am very optimistic on the fire-resisting quality of Portland-cement construction, more so than Captain Sewell is, I suspect, from some of his remarks of a few moments ago. One great advantage of Portland-cement concrete construction is that if you put it in wet and soft, and almost semi-fluid, it will fill the voids and leave no bad "blow-holes" or cavities, even under mediocre care and incompetent supervision. The careless workman thus has less chance to get a poor joint than in brickwork. With the modern finely-ground cements, if a slight excess of cement is used above that theoretically deeded to fill the voids between the grains of sand, and, if the whole is thoroughly mixed, as it can be easily by modern machines for this purpose, it excludes air and moisture and opportunity for corrosion. The Portland-cement concrete possesses far greater tensile strength and shearing strength than the best brickword, and, in brief, I believe that it presents a material for fire-resisting construction which is not excelled by anything yet known.

Some experiments have been recntly carried on in Boston which indicate that Portland cement is the best known substance for protecting steel against corrosion, and I have been very glad this evening to hear Captain Sewell speak such a good word for filling everything around the steel frame up solid with cement mortar—puttting it around the main steel columns of buildings—placing the cement everywhere in close contact with the steel.

That air spaces around steel frames are a delusion and a snare was shown repeatedly in the Baltimore fire; and there is no way in which you can so thoroughly protect your steel work against corrosion, no way in which you can come so near to making a tall steel skeleton building endure like one of the pyramids of Egypt, as to thoroughly encase the steel work in good, rich Portland-cement concrete. The excess of alkali seems to be just what is needed to prevent the tendency to corrosion.

In my practice as an hydraulic engineer, I have had opportunity to inspect the condition of much steel, while it was being torn out, after from ten to twenty years' use, in cement-lined water-pipes. Presumably, every insurance man detests the cement-lined water-pipe, because of the way it gets struck by lightning, and the way it sometimes has of letting go when the man shuts off a hydrant too quickly, and because of the frequency of shut-offs for repairs in systems not originally faithfully put down, when they become old; but it has done good service in helping to teach the value of Portland cement as a preservative for steel. I have in general found that where the Portland-cement mortar was sufficiently rich in cement, and was put in close contact with the steel or iron pipe-shell, that the steel or iron was commonly as fresh and free from rust as the day it was put into the trench. The rust holes nearly all appear to come where the work has been slighted, the mortar poor, or not applied in close contact to the steel.

Non-Conductors in Fireproof Safes

The general failure of the common portable fireproof safes in the Baltimore fire was very noticeable.

Here is another problem for the underwriters' laboratory staff.

The contents of fireproof safes have, perhaps, not been so frequently an article of insurance in the past as they will be in the future by those men of Baltimore who had safes in that fire. It was really a pitiable sight to go through those ruins and see the large proportion of fireproof safes that had failed to preserve their contents. More than 75 per cent. at a guess, of the common portable safes had failed. This is not to be wondered at when one considers the ordinary construction. If one will examine the magnesia steam-pipe coverings in the same rooms in which safes had failed, he will see many that were only an inch in thickness that endured well and protected what was inside. These point an easy way for preventing the heat from reaching the contents of a safe so quickly. Simply provide an inch or two of magnesia slab inside the cement structure of the safe and continuity of metal to the interior.

If the gentlemen here would furnish the funds and the safes, I am sure we could promptly find half a dozen places in this country where there is already just the kind of laboratory needed for testing them. The "soaking-pit," as they call it, in any great steel-making plant, like at Sparraws' Point, or that at South Chicago, for example, where they take the great hot ingots and store them for several hours in a great covered pit heated to a glowing yellow heat—a heat far above the temperature of a great conflagration—furnishes excellent conditions for a thorough test, with cranes of ample power for lifting the safes in and out.

Take two safes built in different ways. Put books, papers, wood, fusible alloys and a recording therometer inside of each. Expose them to that heat for half an hour and then pull them out; or, again, for an hour and then pull them out, and then for two hours and pull them out, and much will be added to the general knowledge of how to build a safe that is safe.

It would detain you too long to hear more lessons from the Baltimore fire, but the man who is interested in studying fire-protection engineering can find no better school to-day.

(THE END)

FIRE DEPARTMENT NEWS

The report of Chief O. G. Marjenhoff, of the Charleston, S. C., Fire Department for 1904, shows 183 alarms responded to, 16 of which proved false. The estimated amount of property at risk was $944,355, and the total loss, $47,222, of which $41,423 was covered by insurance. The average loss for the past 11 years has been $34,-314 per year. There were 66,300 feet of hose laid; 3,706 feet of ladders raised, and an estimated number of 968,500 gallons of water used. The average quickest time for full companies of twelve men each to answer roll call at fires or alarms from first stroke of gongs was 9 minutes in day time and 11 minutes at night.

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In Birmingham, England, all police recruits are trained for the first examination in ambulance work. Afterwards they must prepare for the second and third certificates of proficiency, and must attend each year a revision class to keep themselves up to date with the development of ambulance work. The system has been found to work most admirably, and first aid to the injured has been given by the police in over 2,000 cases since 1902, the life of the person being saved by this timely assistance in a number of instances. Of 860 policemen on the force, 818 have passed the first aid class.

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The Fall River, Mass., Police Department report for the year 1904 shows a total of 3,625 arrests, which is a decrease of 1,072 from the year before, and 723 less than the average for the nine previous years. The percentage of arrests to the population was 3.18. The number of males was 3,043; of females, 582; of foreigners, 2,090; of non-residents, 559. The number of juvenile offenders was 340, of whom 114 were of foreign birth and 287 of foreign parentage. Of offences for which there were 50, or more, arrests, 1,807 were for drunkenness; 316 disturbing the peace; 291 for larceny; 250 for assault and battery; 97 for violation of Lord's Day; 86 for violation of city ordinances; 85 neglect to support family; 78 breaking and entering a building; 60 for fornication, and 50 for malicious mischief.

The per cent. of foreigners arrested is 20.86 greater than the per cent. of population of foreign birth, and the per cent. of persons between the ages of 20 and 39 years arrested exceeds the per cent. of the population between those ages by 51.36.

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Fire Department statistics of Atlanta, Ga., for 1904 give a total of 572 alarms answered, which is an increase of 68 over the year previous. The buildings are classified as 369 frame; 66 brick and stone, and 2 freight cars. The causes of fire: 120 unknown; defective chimney, 47; sparks from chimney, 154; defective flue, 28; carelessness with matches, 10; other causes, 178; out of city, 13, and false 22. Damage on buildings is estimated at $75,521, and on contents, $73,843, a total of $149,364. The total value of buildings and contents is placed at $4,643,639, and the total insurance was $3,043,954.

W. R. Joyner, Chief of the Department, recommends in his report one new engine company with equipment for the southeastern part of the city, which is growing rapidly, and a new company for the eighth ward and two new hook and ladder companies. There are now in service three hook and ladder trucks, six steamers, nine hose wagons and two chemical engines, with a reserve of one water tower, two Joyner turret pipes, one steamer and one hose wagon loaded with 1,000 feet of hose.

Chief Joyner also calls attention to the great number of shingle roofs on buildings, which he asserts are more frequent in Atlanta than in any other city of its size, and are such a menace to property that provision should be made against their increase.

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The fire loss in Salt Lake City for the year 1904 was much below the average for the past 15 years. Chief W. H. Bywater reports a total of 202 alarms responded to, or 52 more than the average since 1890. The number of miles traveled in going to fires was 387; the number of feet of hose stretched was 31,150; the time in service 168 hours and 13 minutes. The estimated value of buildings and contents endangered was $3,067,667; the insurance involved, $1,565,400. The actual losses sustained were $41,170.74, and uninsured losses were $10,696. The cost of the department for the year was $47,615.57.

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Fire Chief N. A. Ball of Oakland, Cal., asks for his Department for a new reserve steamer; that two trucks with chemical apparatus attached be provided for stations; that one new engine company be organized and equipped; that one hose company be changed to an engine company, and that all the hose carts now in service be replaced by hose wagons.

The efficiency of the men was tested during the year by 223 fires. The number of hours of work was 706; 1659¾ miles were traveled to and from fires; 125,150 feet of hose was laid and 550 feet of ladders raised. The losses by fire was estimated at $149,573, and the amount actually paid by the insurance companies was $124,072.73.

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Recommendations for a radical improvement of the Bridgeport Fire Department are made in Chief Mooney's annual report. His plan of improvement calls for: one chemical engine and quarters for the same; two steam fire engines of the first class; one combination chemical truck and equipments; two new combination hose wagons; chemical tanks on all hose wagons; a repair and blacksmith shop; two new engine houses and equipments, two steam fire engines, and two combination chemical hose wagons and 5,000 feet of hose; repairs to engine houses; a drill station; increased number of hydrants and gate valves; 20 new fire alarm boxes, and horses and other equipments. All at a total estimated cost of $125,000. He also recommends an addition of 18 men to the present force, and that all fire alarm and telegraph wires possible be placed underground.

It is intimated that in making such a large request of the Board at this time, Chief Mooney is encouraged by some powerful backing, which is attributed to the Manufacturers Association that has been systematically investigating on this line for some time.

THE REPORT OF JOHN P. QUIGLEY, Chief of the Syracuse, N. Y., Fire Department for the year 1904 shows the total number of alarms responded to by the Department was 343, of which 34 were false; 39 were out on arrival; 1 was an accident call; 3 were outside of the city; 23 were extinguished by engine; 104 by hydrant stream; 86 by chemicals; 53 by pails, etc. The loss on buildings was $91,659.06 and the insurance $1,046,150; the loss on contents, $138,735.71 and the insurance $1,006,597. There has been a net increase in the force of 11 men. The department owns 77 horses, and has on hand 20,200 feet of serviceable hose, 4,800 feet of which should be replaced; 6,000 feet were added during the year.

He recommends a gradual increase in the number of companies; that a manual system of alarms be instituted; that a salvage corps be organized, and that additional protection be afforded the manufacturing section adjoining the West Shore railroad station.

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FIRE NEWS FROM ELMIRA.—There were 192 alarms sent in to the Elmira, N. Y., Fire Department during 1904, 61 of which were box alarms and 126 telephone or verbal, and five false. More fires occurred in day time than at night; 127 were in frame buildings; 24 in brick buildings, and 33 were other than building fires. Only three extended to adjoining buildings and 133 were confined to the floor on which they originated.

The loss on buildings $104,147.83 and the insurance was $461,900, and on contents the loss was $34,668.22, insured for $141,042. Five casualties were reported, death resulting in three instances, and two being seriously injured.

Chief John H. Espey asks for an increase in the force to 41 full paid men and recommends a general overhauling of the apparatus of the department together with the purchase of new material, and the extension of the water service and fire alarm boxes. He also recommends that all fire alarm poles be painted a bright red to a height of six feet, and have a red light attached to an arm so that the light may be seen at a distance. Attention is also called to necessary compliance with the recommendations of the Department of theatres and public institutions for the protection of their occupants.

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THE NEW ORLEANS FIRE DEPARTMENT as at present organized consists of 27 steam engine companies; 9 four-wheeled hose carriages; 11 two-wheeled hose carts; 5 four-wheeled hose wagons; 8 hook and ladder trucks and one water tower. There is a total force of 295 officers and men. During the year the Department responded to 518 actual fires, 57 unnecessary alarms and 12 false alarms, a total of 587 alarms. The total losses were $720,141, with insurance amounting to $3,409,294.

In his annual report the Chief Engineer calls attention to the necessity for immediate and extended improvements demanded by the Department in the matter of equipment and water facilities due more to the rapid growth of the city than to the deteriorating of the present service. And he urgently recommends the establishment of a training school for novices entering the Department to bring them to the point of efficiency which the service demands.

Fire and Police Personals

—Mayor Boylen, of Gloucester City, N. J., appointed Thomas Hughes chief of police vice James Foster, but the latter refuses to step down and out, and is supported by a majority of the council. The question will probably go to the courts.

—At the election held February 14, John Veech was chosen Chief of the Passaic, N. J., Fire Department by an overwhelming majority; and Hugh Waters, of the Howe Engine Company was elected assistant chief. Mr. Veech has been assistant chief and his promotion is regarded as having been earned through exceptional merit.

—Chief Espey, of the Elmira, N. Y., fire department is thoroughly disgusted with the method of turning in alarms by telephone. He finds that on nearly all occasions when the firemen go to the wrong house the alarms have been sent in by telephone, and he naturally objects to having his men sent on a wild goose chase hunting up a fire.

—An organization of the veteran fire chiefs of the state of New Jersey, similar to the existing organizations in New York and Massachusetts, was effected on February 15, at Elizabeth. Chiefs D. J. O'Neil, of Ridgewood, John Stagg. of Paterson and Kiersted of Newark are leaders in the movement.

—William W. Wheeler is the new chief of the Nashua, N. H., police department, having been elected to fill the vacancy caused by the resignation of Alvin S. Eaton. George H. Campbell was elected assistant marshall and Mart. E. Watson was made captain. These appointments are all promotions, and have been uninfluenced by politics.

—The Youngstown fire department responded to 278 alarms during 1904, being 21 less than in 1903. The total losses $98,850, and the net losses above insurance were $1,924. There are 52 officers and men in the service. The purchase of a new aerial truck, the installing of a department telephone service, and several new horses are recommended by Chief W. H. Loller.

—Engineer C. W. Hubbell of the Detroit, Mich., Board of Water Commissioners, recommends an expenditure of $60,000 to install larger water mains where needed for better fire protection. He also suggests a thorough investigation of conditions as to electrolysis in the water pipes. The present capacity of the plant is estimated sufficient for the needs of the city for the next ten years.

—The Tacoma, Wash., Fire Department traveled 1,726 miles in responding to 346 alarms. At the fires there were laid 62,905 feet of hose and 908 gallons of chemicals were used. The total losses are estimated at $42,697—the smallest amount in five years—of which $36,314 was paid by insurance. The department numbers 59 men, and is well equipped with fire fighting apparatus.

—The Binghamton, N. Y., fire department was in service at fires during 1904 for 27½ hours. There were 101 alarms; 20,450 feet of hose laid; a total loss of $38,031, of which $21,082 was in one fire. This total was $68,000 less than that of the year previous. A large new engine is recommended by Chief Hogg, and a storage cistern in the center of the city.

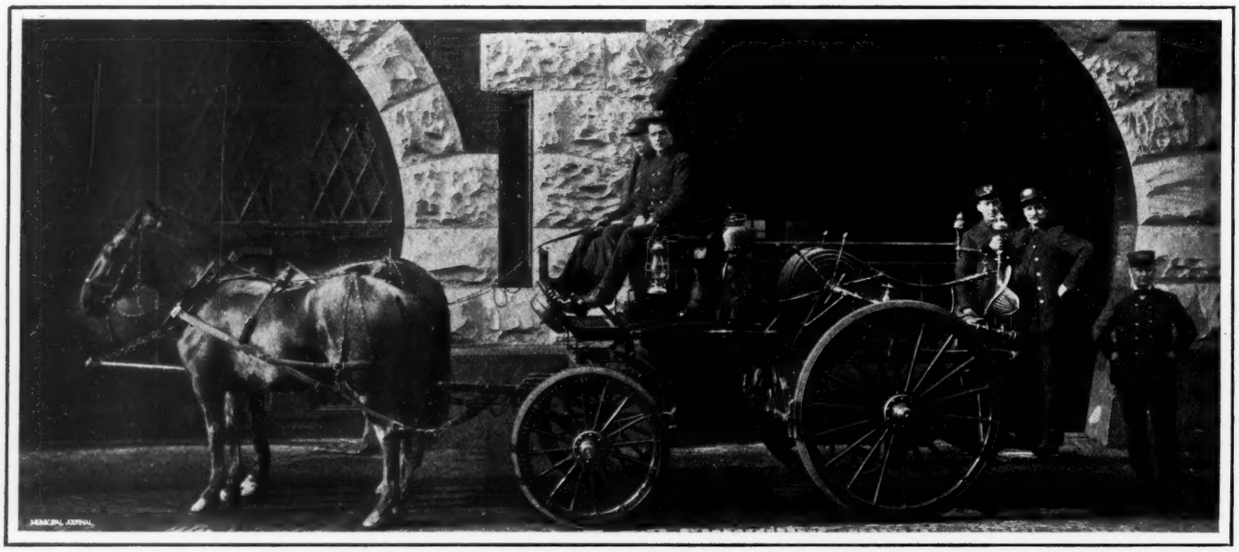
—A "shake-up" has recently occurred in the Philadelphia Police Department and the program calls for more transfers of patrolmen in the immediate future. This is a result of a crusade instituted by the W. C. T. U. and by the clergy of the city against the "white slave traffic." Mayor Weaver asserts that the subject has been grossly exaggerated in the public press, but emphatic repressive measures are being taken to close the dens and punish the offenders.

—The total loss by fire in Jersey City, during 1904, was $1,163,336, which is more than double that of the year previous. The largest fire, that at the Lackawanna Railroad docks, on May 29, entailed a damage of $660,000 which alone accounts for the increase. There are thirteen engine, six hook and ladder and three chemical engine companies manned by a force of 190 men, and Chief John Conway recommends an increase of two men to each company. He reports the apparatus all in excellent condition.

—Superintendent of Police John J. Hogan, of Troy, N. Y., in his annual report says: "No crimes of a serious nature have occurred and disorder of every nature has been the subject for instant investigation and the prosecution of the offenders." From a place which had formerly an unenviable reputation for toughness this is a fine record for the efficiency and discipline of the department. The Chief recommends the purchase of a patrol wagon; the establishment of a police signal system and the adoption of the system for the identification of criminals by finger prints.

—The Montreal fire department received 1,144 alarms last year, of which 168 were false, and most of them due to interference with overhead wires. The superintendent recommends a change to underground wires, and also advocates the adoption of the system in vogue in the United States whereby an alarm is not sounded in the fire house unless it is in the district served by the company. At present the men are all tumbled out of bed for every alarm in any section of the city.

—Mayor Sylvester, superintendent of police at Washington, said many good things in a paper read before the Ohio Police Convention held recently at Toledo, and strongly advocated a closer and more sympathetic relation between the policeman and the citizen. Admitting that politics and graft had been of effect in lowering the public ideal in some communities of these servants of the law, he combatted the idea that the whole should be judged by the incompetence of the few. "Those," he declared, "who should awaken to the proper care of person and property are the citizens, and they should insist on those to whom they assign the task of originating and maintaining the police, to perfect the organizations, to eliminate imperfections, to make them trustworthy and diligent."



LEXINGTON, KY., CHEMICAL EQUIPPED WITH "FIRESTONE" RUBBER TIRES, MADE BY THE FIRESTONE TIRE AND RUBBER COMPANY, AKRON, O.

LITERATURE ON MUNICIPAL TOPICS*

Reviews of Some Important Books—What the Magazines and Reviews Have to Say about Civic Affairs—Municipal Reports Received

Life and Labor of the People in London. By Charles Booth. Second Series: *Industry,* 5 vols. Cloth, 8vo. Price 20s. the set. Second Notice. In a former issue a review of the first volume of this series was undertaken. Volumes 2, 3 and 4 continue the analysis of census figures for groups of industries begun in volume one and illustrate the conditions surrounding each class. Volume 2 treats of Precious Metals; Watches and Instruments; Sundry Manufacturers; Printing and Paper Trades; The Textile Trades. Volume 3, of Dress; Food and Drink; Dealers and Clerks; Locomotion, etc.; Labor. Volume 4, of Public Service and Professional Classes; Domestic Service; The Unoccupied Classes; Inmates of Institutions.

It is with volume 5, which the author devotes to comparisons of the varying conditions detailed, and to a general survey of the vast array of statistics produced, and states his deductions and conclusions at which he has arrived after a thorough sifting and arrangement of this mass of material, to which we must limit further notice.

The characteristics of modern industry as developed from a careful study of this mass of detail are, the speculative forestalling of wants, by which the simple conditions of earlier times, when the demand was the origin of supply and the consumer sought out the producer, has been radically changed, and the present conditions substituted, whereby the producer seeks the consumer and attempts to forestall, or even to create the demand for his product.

This leads to a great complexity of operation involving strenuous efforts to attract attention and secure publicity, with the attendant expenses of advertising and travelling salesmen; a cheapening of products and a tendency to a lowering of wages; a sub-division of labor, whereby the workman undertakes but a single operation in the process of manufacture; the necessity for intelligent management and good leadership, with a corresponding increase of responsibility.

The results are a cheapening and a multiplication of products, permitting a rising standard of life and extending the field of industrial action. And to which are added a train of evils—the misbegotten offspring of prosperity—for which men seek a remedy.

That there should be no poverty with industry, the author states as an oxiom, but that it does exist is a too palpable fact. And, though he finds no single panacea for long hours, low wages, irregularity of earnings, lack of employment and other evils, he does find that relief may be had in education, both of laborer, employer and consumer; in the broader and more scientific consideration of the questions involved by the trades unions, and in the greater willingness of the workman to give fair value for the wages received.

On this latter point he says: "The threat 'pay us well or we will serve you ill,' cannot compare in effectiveness with the demand 'pay us well because we serve you well.' If wages are to be raised to the utmost and then maintained at the top level, it is essential that the wage-earner should consider first the interests of the employer. * * * It is only by giving his best services that any man is in a position to insist upon a full reward. In this way each individual must seek industrial salvation. For low wages there is no other cure, and what is true of one man is true also of the mass. Underlying all that may be done for him by combination or by legislation or by public sentiment, the individual, in asserting his claim to a living wage, needs to base his action on a sounder philosophy and a firmer faith than that which usually prevails. To be as useful as possible—such is the Gospel of industry; and there is no one high or low, rich or poor, to whom it does not apply."

This series presents the social and industrial statistics of the world's metropolis in a succinct form, and in the deductions which the author has drawn he has not introduced arguments to sustain personal opinions nor made an effort to distort a perfect view of the people of London of the present age, his work will, therefore, be of use not merely to the students of sociolological problems of the present, but will prove of value to future students.

The Telephone Service, Its Past, Its Present, and Its Future, by Herbert Laws Webb, M. I .E. E. London, 1904. This is a charmingly written brochure on a familiar and therefore unusually dry subject. The author explains the apparatus and its workings, asserting that "the Bell telephone, the instrument we now know as the 'receiver,' is the most delicate electrical instrument known to science. The amount of current passing through an ordinary incandescent lamp would, if subdivided, make an audible sound in all the telephones in use in the world."

While Americans turn to England and the Continent for ideas of control of quasi-public utilities, Mr. Webb quotes New World methods to his British readers. "In New York, Boston and Chicago," he says, "there are more telephones in use than in the whole of Great Britain, and in the United States the telephone service has already reached the position of being regarded as practically indispensable." England's laggard growth, he attributes to government interference, and Continental countries, with the possible exception of Germany, are far behind England in the use of telephones, and in localities where it has been more actively developed, "the burden and the heat of the day has been borne by private enterprise, and Government control has only lately become an active, and, as usual, a more or less repressive factor in the situation."

* Any book or periodical reviewed or mentioned in THE MUNICIPAL JOURNAL, or elsewhere, will be sent to any address on receipt of price.

Urban Police and Sanitary Legislation, 1904. Compiled and arranged by Frank Noel Keen. London, 1905. P. S. King & Son. English municipalities, as well as those of our own country, are in continual need of extended powers to enable them to deal with new or changed conditions. These are granted by Parliament, as by our Legislatures, in the form of special bills. The committee of the House of Commons considered, in 1904, twenty-two such measures, eleven of which originated with the several Urban District Councils of the cities interested. To generalize these specific measures into a code suitable for cities of a class is the work Mr. King has undertaken, and this book gives the result of his analysis and comparison of the eleven bills mentioned on the subjects of Sanitary and Police Regulations. In the synopsis of the act, arrangement of the subject matter and the index, the author has performed an immense amount of most painstaking labor, and has succeeded in preparing a digest which will be of incalculable help in maintaining symmetry in future legislation.

Among the provisions, which in the main are similar to those of American city charters, may be noted a greater caution against the spread of infectious diseases than is common in this country. No person, under penalty, may return to a public library a book exposed to infection from any infectious disease, but shall turn it over to the inspector of nuisances for disinfection. And dairymen must report cases of infectious diseases not only in the places from which they secure their supplies, but among their customers; if they are stopped from doing business, they are to be compensated out of the district fund. No person with infectious disease may milk a cow, pick fruit or engage in any business connected with food intended for consumption. These are precautions worthy of imitation.

Webster's International Dictionary. A new edition, 1905. A dictionary other than a lexicon of a dead language, is merely a lingual mile post and indicates how far a people have gone in the journey of civilization. Its province is to photograph the speech of the time showing the flexions of measuring and sound. In periods when the pace is rapid it must be continually revised and re-edited to keep it up to date. And it must, also, be historical, giving the origin and development of each word so that its true mathematical weight may be determined.

The publishers of Webster's International Dictionary appreciate the necessity of keeping abreast of the time, and though the original edition, published in 1847, was authority at that time, and the revised editions of 1864 and 1890 were invaluable at those dates, the work was entirely recast in 1900, and by means of an elastic supplement is kept up to date.

As a result of the accelerating progress of the race new words by the thousand and the ten-thousand are coming into the language, and old words are wearing new faces. It is these new words and new meanings for which one seeks, and which give value to a dictionary and the management of Webster's are evidently determined that it shall continue to be what it has been and is now, the "Standard" American Dictionary.

Articles in American Periodicals

In *The Inland Architect and News Record,* Chicago, February, is an article on *The Landscape Architect and His Work,* by Howard Evarts Weed, Landscape Architect, and read before the Chicago Architectural Club, October, 1904; also an article by Frederick Baumann, Architect, on *Fireproof Construction of Theaters.*

An illustrated article on *New Track Systems for City Streets* is published in the *Engineering Record,* New York, February 25; also an illustrated article on *The Subway of the Philadelphia Rapid Transit Co.*

In the *Street Railway Journal,* New York, March 4, is an illustrated article on *The Electrification of the London Underground Electric Railway Company's System,* by S. B. Fortenbaugh, Electrical Engineer of the company; also an article *On Track Bonding,* an abstract from a paper presented at the meeting of the American Institute of Electrical Engineers, held in New York, February 24, 1905, by C. W. Ricker.

Experiments on Reinforced Concrete Pipes Made for the U. S. Reclamation Service is an article appearing in the *Engineering News,* New York, March 9, by J. H. Quinton, M. Am. Soc. C. E., Consulting Engineer, Reclamation Service, U. S. G. S., Washington, D. C.; also an article by Charles R. Steiner, Assistant Engineer U. S. G. S., Montrose, Colo., entitled the *Economical Construction of Reinforced Concrete Beams and Floor Slabs.*

Amusements for Park Resorts is an illustrated article appearing in the *Street Railway Journal,* New York, March 11, and is extensive in the ground covered.

In *The Annals,* Philadelphia, March, are eight articles worthy of special attention: *Municipal Nomination Reform,* by Horace E. Deming, Esq., Chairman Committee on Nomination Reform, National Municipal League, New York City; *The Development of Park Systems in American Cities,* by Andrew White Crawford, Esq., Secretary City Parks Association, Philadelphia, Pa.; *The Reform Movement in Chicago,* by Hoyt King, Secretary Legislative Voters' League; *The Housing Problem in American Cities,* by Lawrence Veiller, Secretary, City Club, Deputy Tenement House Commissioner, New York City, 1902-1904; *The Progress of Sanitation in Great Britain,* by Dr. A. K. Chalmers, D. P. H. (Camb.), Medical Officer of Health, Glasgow, Scotland; *Medical Inspection of Public Schools,* by Lillian D. Wald, Nurses' Settlement, New York; *Recent Extensions of Municipal Functions in the United States,* by Professor John A. Fairlie, University of Michigan; *The Reorganization of Local Government in Cuba,* a paper read before the American Political Science Association, Chicago, December 29, 1904, by Dr. L. S. Rowe, Professor of Political Science in the University of Pennsylvania.

An illustrated article on the *Gravity Tunnel for the New Water Works of Cincinnati* is published in *The Engineering Record,* March 4, New York. It is written by J. A. Hiller, Assoc, M. Am. Soc. C. E., Resident Engineer.

An illustrated and tabulated article on the *Disintegration of Portland Cement Briquettes by Oil and Experiments to*

Prevent It, by James C. Hain, Assoc. M. Am. Soc. C. E., and Engineer of Masonry Construction, Chicago, Milwaukee and St. Paul Railway, Chicago, Ill., appears in the *Engineering News,* New York, March 16.

A New Form of Filter Gallery at Nancy, France, is an article by E. A. Gieseler, C. E., Berlin, in *The Engineering Record,* New York, February 11.

A Three-Hinged Concrete Steel Arch, is a paper read before the Ohio Engineering Society by L. A. Keith, City Engineer, of Mansfield, Ohio, and appears in *The Engineering Record,* New York, February 18.

Articles Appearing in Foreign Periodicals

Building By-Laws and their Administration, a report to the Council of the Borough of Reigate, by C. J. Grece, LL.D., Town Clerk of Reigate, appears in *The Sanitary Record and Journal of Sanitary and Municipal Engineering,* Fetter Lane, London, E. C., February 16. 1d.

The Origin of Municipalities, a lecture delivered at the Liverpool University by Mr. Edward R. Pickmere, M. A., Town Clerk of Liverpool, appears in *The Municipal Journal,* London, February 17. Price 1d.

An article on the *Purification of Paris River Water* appears in *Water,* 25 Victoria street, Westminster, London, S. W., February 15. Price 6d.

In *The Surveyor and Municipal and County Engineer,* London, Eng., is an article on *Buxton Mineral Waters and Baths,* by John Hatton, Assistant Surveyor to the Buxton Urban District Council; also an article on *The Manufacture and Sanitary Uses of Natural Mineral Rock Asphalt,* by H. D. Blake, M. R. S. I. February 17. Price 3d.

The Ventilation of Sewers, an extract from a report to the Borough Council of Kensington, England, by Dr. T. Orme Dudfield, Medical Officer of Health, appears in *The Sanitary Record and Journal of Sanitary and Municipal Engineering,* London, February 23. Price 3d.

Artificial Stone for Footways, the report of the City Surveyor of Manchester, England, appears in the *Surveyor and Municipal and County Engineer,* March 3, London, England. Price 3d.

An illustrated article appears in *The Surveyor and Municipal and County Engineer,* March 10, London, England, on *Tramway Permanent Way,* giving points in construction and maintenance, and read before the local section of the Institution of Electrical Engineers, by Mr. James Lord, Assoc. M. Inst. C. E., and borough engineer of Halifax. Price 3d.

Public Documents Received

Eleventh annual report of Bristol, Conn., for 1903-4. Hon. John F. Wade, warden.

Fifty-second annual report of board of Water Commissioners, Detroit, Mich., for 1903-4. Hon. Darius D. Thorp, president.

Annual reports of Wallingford, Conn., for 1904. Hon. Henry B. Hall, warden.

Report of board of Electrical Commissioners, Wallingford, Conn., for 1903-4. A. L. Pierce, superintendent.

Thirty-eigth annual report of board of Water Commissioners, Middletown, N. Y., for 1904. T. W. Davey, superintendent.

Fourth annual report of department of Public Works, Troy, N. Y., for 1903. John Flynn, Jr., city engineer.

Report on Sewage Disposal, New Britain, Conn., William H. Caldwell, engineer.

Annual reports of Bridgeport, Conn., for 1904. Hon. Dennis Mulvihill, mayor.

Annual report of department of Electric Lighting of Chicopee, Mass., for 1903. George E. Stebbins, manager.

Annual reports of Rockville, Conn., for 1904. Hon. George Forster, mayor.

Report of the Sewage Commission of Connecticut, 1899. Edward H. Jenkins, Ph. D., chairman.

Bulletin 17 of Department of Commerce and Labor, at Washington, D. C., on telephones and telegraphs, 1902. S. N. D. North, director.

Third annual report of department of Public Works, Scranton, Pa., for 1903. B. T. Jayne, director.

Eleventh annual report of Bristol, Conn., for 1903-4. Hon. John F. Wade, warden.

Annual report of Water Commissioners, Binghamton, N. Y., for 1903. Jefferson Kingman, president.

Annual report of City Engineer, Binghamton, N. Y., for 1903. S. M. Baird, city engineer.

Annual reports of Grand Rapids, Mich., for 1902-3. Hon. W. Millard Palmer, mayor.

Mayor's message and annual reports of Auburn, N. Y., for 1903-4. Hon. Thos. M. Osborne, mayor.

First annual report of Public Works Committee, Norwich, Conn., for 1903-4. J. B. Morrell, superintendent.

Annual reports of Holyoke, Mass., for 1903. Hon. Arthur B. Chapin, mayor.

Thirtieth annual report of the board of Water Commissioners, Springfield, Mass., for 1903. A. E. Martin, superintendent.

Special report of board of Water Commissioners, Springfield, Mass., for 1902. Percy M. Blake, consulting engineer.

Annual report of City Engineer, Springfield, Mass., for 1903. Charles M. Slocum, city engineer.

Annual report of the Superintendent of Streets and Sewers, Springfield, Mass, for 1903. Arthur A. Adams, superintendent.

Inaugural address of Mayor of Chicopee, Mass. Hon. Albert E. Taylor, mayor.

Annual reports of New Britain, Conn., for 1903-4. Hon. Samuel Bassett, mayor.

Annual report of Police department of Fall River, Mass., for 1904. Rufus W. Bassett, commissioner.

Annual reports of Middletown, Conn., for 1903. Hon. Lyman D. Mills, mayor.

Annual reports of Meriden, Conn., for 1904. Hon. George S. Seeley, mayor.

Annual reports of Stamford, Conn., for 1904. Hon. Homer S. Cummings, mayor.

Annual reports of Water and Sewer Commissioners of New London, Conn., for 1903-4. W. H. Richards, engineer.

MUNICIPAL LIGHTING BY ACETYLENE GAS

"There is a great future for acetylene town lighting plants in this country," said a well-known expert after investigating the plant at Farmington, N. H., a town of 3,000 population.

In smaller towns, especially those without a constant and reliable water power, dependence on kerosene oil for lighting purposes will be necessary for many years to come, as the limited amount of service does not warrant the investment of capital to establish electrical plants, and patrons must either pay exorbitant rates, or be content with inferior service limited to the earlier hours of the night.

Acetylene is destined, for many reasons, to supply such towns. It is universally acknowledged to be the cheapest, safest, whitest, steadiest, coolest and, in short, the best illuminant known.

When a system is properly installed, it is a paying investment from the start. A plant may be established anywhere, and without regard to water power or fuel facilities. The gas product may be used for power in engines and for cooking purposes as well as for lighting. And it has a great advantage over ordinary illuminating gas in the fact that there is no danger of asphyxiation from its escape.

The quality of electric light is dependent on many conditions; such as, intelligent and expert operation; the overloading of dynamos; the burning out of dynamos; the slipping of belts, and breaking of machinery; electrical storms; the life of the electric lamp; the cost of fuel, and, with a water plant, high water; low water; no water. In the State of Maine, in 1893, many towns were without electricity entirely on account of the low water.

Mr. York, superintendent of the Farmington, is convinced that the most satisfactory plan for town lighting is by what is known as the storage system, similar to that employed for ordinary coal gas. The gasometer should be constructed to hold a maximum supply of gas for the night and not be dependent upon any automatic device, or upon the care of an attendant for the night's supply. With the storage system sufficient gas is made in the morning for the use at night, and any derangement with the generator may be corrected without shutting off the light, while with mechanical devices, or even attendants, are more or less likely to experience accidents which would leave the consumers in the dark. Automatic attachments are not impracticable, however, in connection with non-automatic plants. It is an established fact that when gas is stored for a time the impurities settle, and the gas cools, and is, therefore, improved in quality.

The generator, which is most practical for town purposes from a money-making standpoint, is one using lump carbide 2 × 3½, or larger, as there is more gas to the pound from this size on account of the unavoidable air slacking of the smaller sizes.

Towns lighted with a carbide to water system usually employ a battery of two complete machines, and, should one fail, the second takes the burden, thereby forestalling a stoppage of the light. For with an automatic generator, if the valves fail to work, or the generator goes wrong, every light on the line goes out, leaving the gas cocks open.

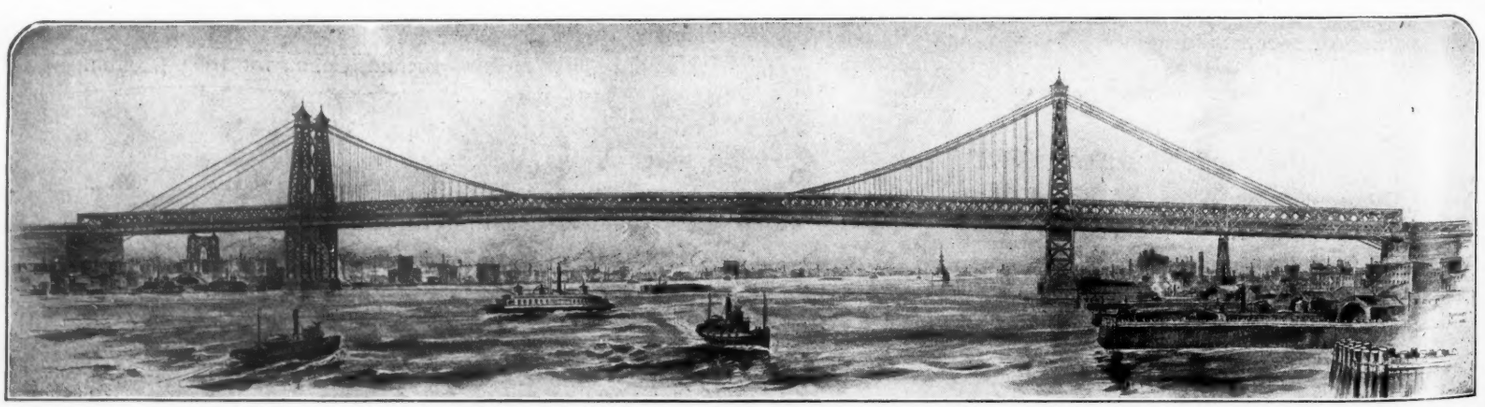
Farmington, N. H., had an oil gas plant built 21 years ago, which cost $21,000. The gasometer has a capacity of 6,000 cubic feet, and there is over five miles of street mains. With six-foot burners a light of only 15 c.-p. was developed, which cost $2 per 1,000 feet, and the service was so unsatisfactory that it was proposed to substitute an electrical plant, when the Victoria Manufacturing Company, of Auburn, Me., purchased the works and installed two acetylene generators. The price was reduced to $1.50 per 1,000 feet, and the lights increased to 24 c.-p. from a ½-foot tip. The success of the new light has been more than satisfactory to the consumers, and the stock of the company is now a gilt-edged investment.

The manipulation of the generators by Mr. York was a simple and interesting operation. The lump carbide rested on a series of grates in, what he termed, a cage; this cage was raised or lowered as desired by a block and fall. All the carbide in each cage, or generator—about 100 pounds—was slaked in about thirty minutes, water attacking it in quantities from the bottom. As the gas was generated it passed into the gasometer. When the gasometer is empty it automatically opens generator No. 2, and slakes the carbide stored in it, and when that is slacked it does the same with generator No. 1. There are no manholes, rubber gaskets, stuffing boxes or valves in these generators. They are operated by a natural hydrostatic law, and there is apparently nothing about them to get out of order. As the water rises to the carbide, the cage being surrounded by a water jacket, it drops through into the bottom of the generator, and is let out at a gate. The generator may be thoroughly flushed with water when ready to be recharged. There being no intermittent action on the carbide, and no back pressure, the coolest generation possible is obtained.

In January, a kerosene stove that had been left burning in the generator house exploded and burned the gas house, causing a loss of $1,000. The gasometer was, at the time, two-thirds filled with gas, and though warped and twisted by the heat of the fire, no explosion or other damage resulted. It was predicted that the necessary repairs would require six months, and the installation of wires for electric lighting was begun. But three days after the fire, by attaching a number of 100-light generators at different points on the system, the service was again in operation.

There are, in the United States, 202 municipalities lighted by acetylene gas, and many more plants in the process of construction. The United States government has adopted it for forts and Indian schools, and is to introduce it in lighthouses, having determined that it is a more positive light and will penetrate farther through fog or distance than any known illuminant.

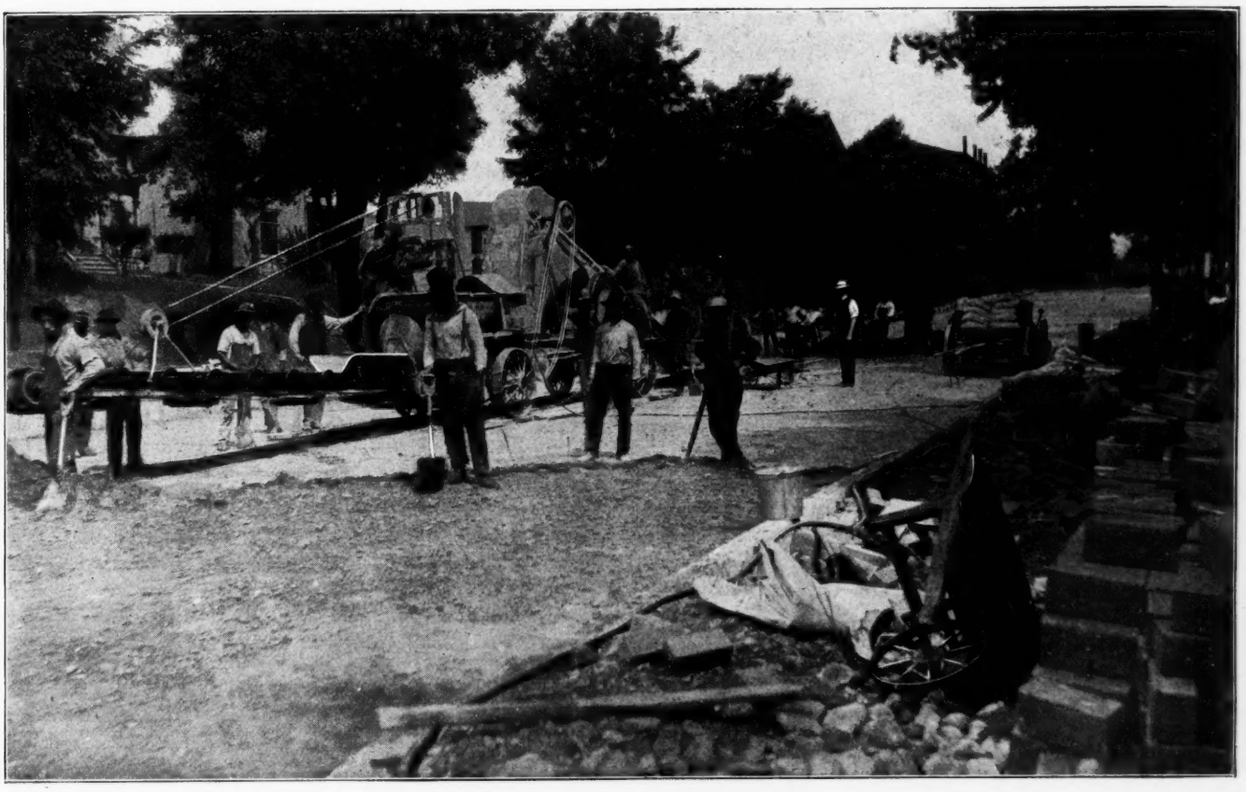
The smaller towns are investigating its merits and adopting it on account of its power, its ease of manipulation and its low cost.



THE NEW WILLIAMSBURG BRIDGE, WHICH COULD BE MOST ECONOMICALLY AND EFFECTIVELY LIGHTED BY ACETYLENE GAS

The Drake Concrete Mixer

THE accompanying cut illustrates a Number 2 Portable Concrete Mixer at work on the streets of Sidney, Ohio. The mixer is built by the Drake Standard Machine Works, of Chicago, and is gaining a high reputation for efficiency wherever introduced. At Sidney, Ohio, an average of 1,450 square yards of 6-inch concrete was mixed per day of ten hours with twenty-six men employed, and the contractor states that the work has been perfectly satisfactory. The city engineer of Greenville, Ohio, is especially pleased with the thoroughness and uniformity with which the materials are mixed and regards the mechanical method as far superior to hand labor. He says: "I believe that the No. 2 machine will mix 1,800 square yards of 6-inch concrete a day easily if the material is put in the machine." Messrs. Kemp, contractors at the latter place, assert that they mixed 1,384 square yards of 6-inch concrete in nine and a half hours with twenty-three men, and say: "We are certainly more than pleased the way the machine works and the way it has reduced the cost of concrete per square yard." At Springfield, Ohio, the No. 2, Portable, run by an 18-horsepower engine, mixed 200 square yards of 6-inch concrete per hour. The greater uniformity of the machine-mixed concrete, together with its great saving in time and labor, makes a thoroughly good machine, a valuable invention.



THE DRAKE CONCRETE MIXER AT WORK IN SIDNEY, O.

The Troy Bottom Dump Wagon

THE Troy Wagon Works Company, of Troy, Ohio, have recently included in their manufacture the building of strictly high grade dumping wagons, their line including a large variety of styles and sizes, and they intend to make this branch an important feature of their output. These wagons are built for the use of contractors and for city street work and include more up-to-date principles, and are better adapted to different kinds of work, than most of the ordinary makes.

The regular equipment of the Troy Dump Wagon includes spring seat, whiffletrees and neck-yoke or tongue chains. A brake operating either on the fore or rear wheels, and steel or asbestos linings are furnished at advanced prices. The wagons are built on honor; the axles are solid steel; the gear parts, tongues, hubs, spokes and rims are of white oak; the sides and ends are of 1¼-inch hardwood, and the bottoms of two pieces of heavily reinforced steel plates, one overlapping the other at the center.

The load may be dumped in any place, as the entire bottom opens at once. One stroke of the lever opens or closes the bottom by means of a very simple device which is not easily gotten out of order. The wagons will turn in their own length. There is nothing useful omitted and nothing useless added. They are built in sizes ranging in capacity from 1½ to 5 cubic yards.

New Scherzer Rolling Lift Bridges

THE second Scherzer rolling lift bridge for the Central Railroad Company of New Jersey across Newark Bay, New Jersey, is rapidly nearing completion. This bridge is being erected in its closed position and constantly carries the railroad traffic without interruption.

During the past month Scherzer bridges were completed and placed into active service at Eighteenth street, Chicago; South Michigan street, Buffalo, N. Y.; Swale River, England, for the South Eastern & Chatham Railway. During the present month the following additional Scherzer bridges will be completed and placed into active service: Union avenue, Third avenue and Hamilton avenue bridges, across Gowanus Canal, Brooklyn; also the long span double-leaf Scherzer bridge at Manhattan avenue, across Newtown Creek waterway, Brooklyn.

The double-track, single-leaf, long span Scherzer bridge recently completed and placed into service for the N. & S. S. R. R., Cleveland, Ohio, has attracted wide attention because of its simplicity and economy. It is being duplicated by the B. & O. R. R. Company at Cleveland at an adjacent site, where a center-pier swing bridge is being removed and replaced. Orders for a number of additional

single, double and multiple track bridges of similar form have been booked by the Scherzer Company, construction contracts to be let this year.

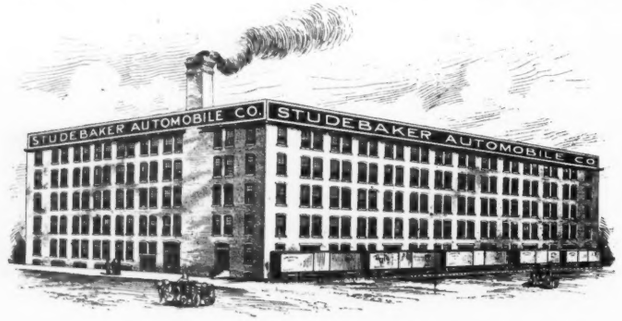
The contract for the construction of the Scherzer bridge for the Buffalo & Susquehanna Railroad and the Pennsylvania Railroad at Buffalo, N. Y., has recently been awarded and work of construction is now in progress. Construction work is also in progress on Scherzer bridges at Twenty-second street, Chicago; Harrison street, Chicago; Flushing, Long Island; Genesee avenue, Saginaw; over the Suir River, Ireland; Spaarne River, Holland; Saugus River, Boston; Malden River, Boston; West River at Kimberly avenue, New Haven; four-track railroad bridges for the N. Y., N. H. & H. R. R. Company at Cos Cob, Conn.; Westport, Conn., and also across the Housatonic River, Connecticut. Among the foreign contracts on which the Scherzer Company is now working is a large highway bridge across the Ekaterinhofka River, St. Petersburg; also a deck bridge of arched outline, forming the movable portion of a long bridge connecting Barrow-in-Furness with Walney Island, England.

A New Disinfectant

Cyllin is a new disinfectant, specially efficient in destroying the germs of tuberculosis, diphtheria, typhoid, plague and all other highly infectious diseases, and one that possesses many superlative qualities to recommend its use. It does not contain carbolic acid or any of its homologues, and is free from the poisonous and irritant action of these agents, its basis being ordinary coal tar. Cyllin is supplied in a concentrated form, and for ordinary use should be diluted to a proportion of one teaspoonful to one quart of water. Its germicidal value has been determined by careful laboratory tests, and was shown by an eminent bacteriologist, in the London *Lancet*, March 21, 1903, to be capable of destroying the highly resistant organization of pus (staphylococcus paurens) in five minutes at a diluted strength of 1 to 400. It proved an efficient bactericide when working on tuberculous sputum at all strengths up to 1 to 800. In a case of intestinal antisepsis it was demonstrated that after eight days' treatment no disagreeable results were produced, whilst a reduction in the number of colon bacilli was obtained to the extent of 97.5 per cent. Cyllin Palatinoids are useful in the treatment of the contagious and inflammatory diseases of the stomach and intestines. As compared with other germicides, exhaustive experiments on vigorous cultures of plague organism give it a value thirty times that of carbolic acid and over eighty times that of formalin (40 per cent.). The Jeyes' Sanitary Compounds Company, of London, is the proprietor, and the American and Foreign Trading Co., 100 William Street, New York, the sole United States agency.

Studebaker Automobiles

One of the surprising developments of American industries is the enormous proportions to which some of them attain. For instance, a little over a generation ago the Studebaker Brothers commenced their industrial career in a small blacksmith shop, performing a limited amount and variety of work. By honest methods, industry and an aggressive policy these brothers have grown to be, in the second generation, the largest makers of harness, vehicles and the like, in the world.



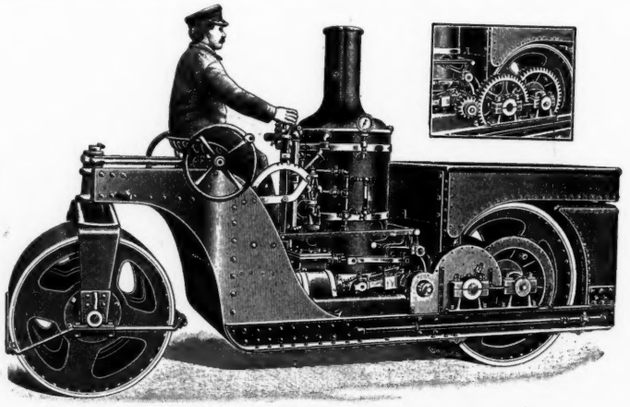
STUDEBAKER'S NEW AUTOMOBILE FACTORY

And still the business expands. The concern has gone into the manufacture of automobiles and it is needless to say that any kind of a vehicle bearing the Studebaker name plate, stands for the best in that line. A new building is now being erected which will be wholly devoted to the manufacture of automobiles. It will be five stories in height, 300 x 200 feet; occupy one and a half acres of ground adjoining the Studebaker vehicle works on the south, and will cost about $175,000. It will be equipped with the latest improved machinery and modern appliances.

"Why Use a Steam Road Roller?"

The Buffalo Steam Roller Company issues a neat circular giving the arguments in favor of the use of steam road rollers, and in form for distribution among the voters of any town considering the purchase of a roller.

An ordinary horse roller exerts about one-fifth as much compression per square inch as the average loaded wagon, which fact



DIRECT GEAR TANDEM ROLLER

alone is sufficient to determine any practical man that a greater pressure must be obtained in building a road to protect it from ordinary traffic than is possible by a horse roller.

It is almost impossible to pick up an old road by hand for the purpose or resurfacing, though it is essential to do so in repairing or rebuilding to secure permanent results. With a steam roller this work is done thoroughly by using picks in the drive wheels. It also serves as traction power for drawing the breaking plow and road grades.

To operate a five-ton horse roller costs from $8.00 to $12.00 per day and not more than 30 or 40 tons of stone can be thoroughly rolled per day. A steam roller is operated at a total expense of $4.00 per day, including wages of engineer, coal and oil, and will roll 100 tons of crushed stone thoroughly. That is, the horse roller is from five to eight times more expensive to operate than the steam roller.

The Diamond Stone-Brick

The city of Philadelphia has placed an order for 5,000,000 of the new Diamond Stone-brick. These brick are meeting the approval of architects and builders where they have been introduced, and the annual output, 18,000,000, of the Warner Company, of Wilmington, Del., is said to have been contracted already.

Special colors are introduced and other pleasing effects in the way of spotted and rough bricks. A test of these sand-lime brick made from samples taken from a pile manufactured last fall and left in the open during the severe weather of last winter gave the following results:

Bricks laid flatwise in the wall. Three natural-colored sand-lime bricks, each 4 in. x 5 in., equal to 20 sq. in., No.1 failed at 2,136 lbs. per square inch; No. 2 failed at 3,035 lbs., and No. 3 failed at 2,982 lbs., the average being 2,718 lbs. per square inch.

For a freezing test, the bricks were immersed in distilled water for a period of 48 hours; then frozen at a temperature of five deg. F. for 16 hours, then immersed in water at 70 deg. F. for eight hours. This operation was repeated 10 times, giving 10 freezings and thawings. Each specimen was natural-colored sand-lime brick, and the weight before the test, dried at 212 deg. F., was 13.89 lbs. The loss of weight due to the ten alternate freezings and thawings was .05 lbs., or .41 per cent., and the only apparent effect of the freezing was shown by a slight rounding of the edges.

A crushing test on three natural colored sand-lime bricks subjected to the freezing test after having been dried 48 hours at 212 deg. F., showed an average of 3,023 lbs. per square inch.

Jandus Arc Street Lighting System

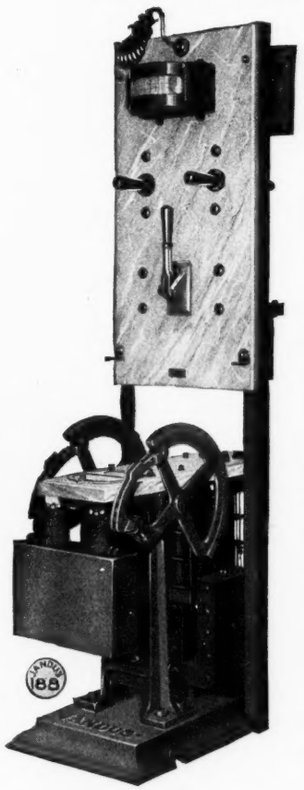


FIG. 1.—REGULATOR AND SWITCHBOARD PANEL.

THE Jandus Electric Company has put upon the market a new system of series alternating arc lighting containing several new features of interest. The accompanying illustrations show the regulator and a special arrangement of regulator and switchboard panel.

The lamp is of the widely known Jandus interchangeable type, the casing, glassware and main body being identified with Jandus lamps for all the classes of service now in use, both alternating and direct current, the integrally mounted mechanisms being interchangeable. The interchangeable feature is obviously of great value to central stations using a variety of circuits, as all lamps may be uniform in appearance and structure, with the same inner globes and carbons, and all repair parts identical excepting those forming part of the interchanged actuating mechanisms. The lamp has a differential mechanism, giving a very close regulation. The long burning life of the lamp (140-175 hours) is specially notable.

The regulator (Fig. 2) is perhaps the most interesting feature of the system. It is of the inductive type and is designed on novel lines. It consists of a base plate and vertical frame upon which is mounted a heavy marble top. This top carries the terminal binding posts and supports the inductive coil. The purpose of this construction is to insulate all the current-carrying parts thoroughly from ground. The coil is stationary so that no flexible leads are required. The core is movably mounted to operate vertically into and out of the stationary coil. A weight is connected to the movable core by means of steel chains located in grooved wheels, which are mounted on finely finished ball bearings. The weight serves to counterbalance the core when the coil is not energized. Through the medium of an adjustable cam on the counterweight side of this system of forces, the moment is made inversely proportional to the magnetic force which actuates the core. The coil is constructed of moisture-proof wire and the insulating heads are of mica, so that the regulator will withstand a short-circuit for an indefinite period.

Fig. 1 illustrates a special feature of the Jandus system whereby the regulator and switchboard panel are installed as a unit, which of course may be multiplied in the central station. This arrangement saves largely in floor space, but its particular advantage consists in compacting all the apparatus necessary to be observed and manipulated, and in installing it within reach of the attendant. In such an installation the operator has before him and within reach every part of the regulator and every switchboard instrument, so that without changing his position he can make all necessary observations and adjustments in starting the circuit.

FIG. 2.—REGULATOR.

The following claims are made as to the advantages of the Jandus regulator: (1) Current-carrying parts suspended from marble and thus thoroughly divorced from ground. (2) Elimination of frictional retardations by use of perfect ball bearings. (3) Fixed coil and movable core. This arrangement requires no flexible connections which are frequent sources of annoyance. (4) Disposition of the counterbalancing weight within the parallelogram of the base. This saves floor space and eliminates the projecting arm, which is often in the way of the station operator. (5) Harmony of design with switchboard panel, permitting the installation of the regulator and switchboard as a unit. (6) An indestructible coil capable of withstanding a short-circuit indefinitely.

The mechanical design of the cam is such that the magnetic pull between the stationary coil and movable core in any relative position of the two is accurately balanced by the counter weight when the current strength is normal. With a tendency to increase of current the entering of the core increases the impedance and tends to decrease the current so that the regulation is practically perfect.

The Ewing-Merkle Company, of St. Louis, Mo., are the general distributers for this apparatus, and have issued a special bulletin, No. 21, D, explaining its working, which is sent on application.

"As Good as" Bitulithic

IN the January number of THE MUNICIPAL JOURNAL reference was made to the failure, as shown by official reports and local newspaper articles, of a pavement laid in Paris, Ky., by contractors furnishing specifications patterned after and providing a construction said to be "as good as" bitulithic, and endeavoring to evade the Warren patents. As another instance of the same class the following excerpt from the Elmira *Gazette and Free Press* of March 8th. The article appeared under the caption, "Trouble Ahead Sure," and read as follows:

"A number of the William Street property owners held a meeting in the offices of the Elmira Mechanics Society last evening and had another talk concerning the pavement laid in the street last summer. The property owners met to ascertain just how badly they had been

flim-flammed, if such is the case, and to discuss some ways and means of protection against the fraud.

"Several attorneys were present last evening at the meeting and gave their legal opinion on the matter. A committee was appointed to formulate a plan of action for the property owners and at the next meeting their report will be given. Samples of the pavement taken at different points along the street were exhibited to those present and opportunity was given all to see just what they were to pay for. One piece of the pavement taken from the block between Market and Church Streets is as hard as flint and a really good sort of substance.

"Another piece of pavement taken from a point above Second Street is of an entirely different nature, and crumbles easily in the hand. It is said by those who have taken the trouble to investigate that the pavement gets poorer and poorer as one goes up the street until the last few blocks of it is not nearly of the standard and quality of that first laid. While a few of the property owners have paid their pavement assessments under protest, a great number have not yet paid and are considering the matter of a contest."

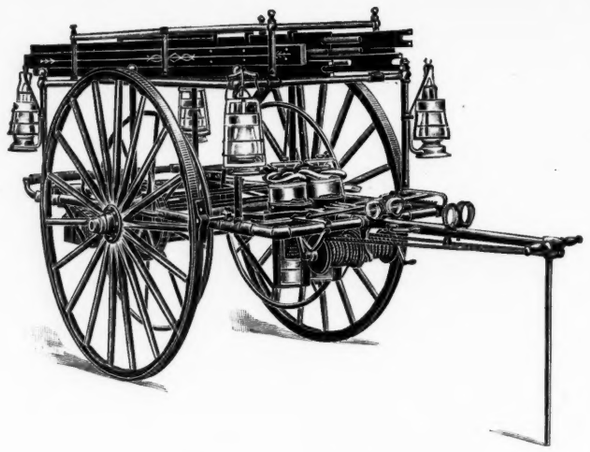
The pavement above referred to was presented to the citizens of Elmira "as good as" bitulithic, and like the Paris, Ky., pavement, although less than six months old, is in an unsatisfactory condition. It is evident that the "as good as" kind of pavement is a poor investment and that cities which want to avail themselves of the advantages of bitulithic pavement can best do so by letting the contracts to parties who are interested in and have the scientific knowledge and experience to make a success of the construction. This is a much better policy than to experiment with those who say they can give a pavement "as good as," although they have never demonstrated the fact. From St. Mary's, Pa., comes the report of another fruitless effort made by an inexperienced contractor to lay a pavement "as good as" bitulithic. The pavement was laid about three years ago and it is reported as follows:

"The entire surface of the pavement being covered with ice about one foot thick, I am unable to advise you of the present condition of the pavement, but I can state to a certainty that the passing of the snow and ice will reveal the pavement, particularly that on Brussels Street, in a deplorable condition, for all of the property owners and city officials whom I have talked with informed me that there were a large number of holes in its last fall, some very large and some about one yard in size. As the contractor had not made repairs required by the guarantee, it will doubtless look a great deal worse this spring than it did last fall. The pavement on St. Michael Street is reported to have a number of holes worn in the surface, but appears better than Brussels Street. Parties with whom I talked are of one opinion, that the cause of the trouble is the raveling of the surface mixture, which was apparently not uniformly or properly compounded. It will require very extensive repairs in the spring. Prior to last year, the Brussels Street pavement has been extensively repaired ever since it was first laid, one strip about 100 feet long for the full width of the street being resurfaced at least three times during the years 1902 and 1903."

The Wirt Hose Reel

The chiefs of fire departments, boards of fire commissioners, managers of public buildings, mayors, aldermen and others will be sure to find information of value in the catalogue recently issued by the Wirt & Knox Mfg. Co., of No. 22 N. 4th St., Philadelphia.

It is said that Wirt's patent tubular all metal hose-reels, carts and hump racks for use by cities, towns, villages, office buildings and city halls are known the world over, and universally acknowledged to be the best on the market. All castings made in the construction of these reels and hump racks are malleable iron. The hose carts made for fire department service may or may not be equipped with ball bearings, as the purchaser desires. The capacity of the different reels has been thoroughly tested, although hose varies so much in weight that it is impossible to give accurate dimensions for all brands. The rubber hose used in making tests, quoted in Company's catalogue, is of standard size, and the cotton rubber-lined is known as mill hose.



THE WIRT HOSE REEL

The particular points about which information may be desired by city officials interested, can be readily ascertained by correspondence.

A New Kind of Paving Material

The Municipal Journal has received a descriptive letter on Kentucky Rock Asphalt, which may be used both in powder and in mastic form, and which seems destined to become a most valuable road-making material. The letter is as follows:

"Believing that the contents of this communication will be of especial interest to many of your readers, I will endeavor to make it as explicit as possible.

"The subject is, 'A Kentucky Rock Asphalt Macadam Roadway,' a material recently discovered, and which has superior advantages not found before in any material used for the purpose of road making.

"On account of its simplicity, cheapness and durability, it will commend itself to engineers who are employed in building macadam roadways in towns, or cities, or boulevards in parks or elsewhere.

"The principal advantages of this rock asphalt macadam are that it will produce a dustless road; it will not get muddy in wet weather; it will not cut out in heavy rains, even on steep grades; it is not slippery, and, when it does become muddy or dusty from effluent from intersecting roads which are not properly paved, it may be readily washed off with a hose or swept off with ordinary street sweepers, without destroying the solidity of the roadway. The reason for this is that the rock asphalt is ground and put on top of the road, and, after a thorough rolling, it becomes so securely compact within a week's time (and without any heating) that nothing short of a pick can remove it. It becomes practically an asphalt pavement, with the top stones of the road for the wearing surface and the asphalt as the binder.

"The low cost of this roadway, as compared with the results obtained, is a very great advantage. In the construction of new macadam it increases the cost but from 20 to 25 cents per square yard.

"No machinery or heating apparatus is required t olay this rock asphalt. A road roller only is needed, and that is required in the making of any kind of a road.

"The most practical specifications to follow in its use to obtain the best results are: Lay 6 inches of broken stone, 2½-inch ring, in place to conform to the contour of the finished roadway; roll this foundation thoroughly in place; spread, loose, on this foundation a 2-inch layer, 1½-inch ring, of clean hard limestone; on top of this spread, loose, three-fourths of an inch of ground Kentucky rock asphalt, distributing it uniformly with rakes; roll it well, which will force the ground asphalt into the voids of the loose stone top, and the result will be that the stone and asphalt will interlock and become a body. After two days, the elements will have compacted the asphalt fit for travel, and in a week the road will be practically in-

destructible. Repairs may be made easily by adding a little stone and asphalt and rolling it in place.

"The discovery of this use for Kentucky rock asphalt is due to the intelligence and practical judgment of Mr. James A. Omberg, Jr., City Engineer of Memphis, Tenn., who, on noting the peculiar action of this natural material, judged that it might be profitably used for some such purpose, and experimented with it, first in a worn-out spot in brick pavement, filling the hole with the material and turning it over to regular traffic. To his surprise, after having been in place for about one week, it appeared like an ordinary sheet asphalt repair job. Concluding to test it farther, he laid two blocks of pavement, as above specified, on the side of Forrest Park, in Memphis, with the result that the 'Omberg' macadam is to-day a pleasant surprise to the engineers who have inspected it, as a solution to the question of building lasting and satisfactory roadways at a minimum cost, and embodying all of the advantages of a more expensive pavement.

"This roadway was laid September 1, 1904, and after an extreme winter, is reported to be in a better condition than at any time since it was laid. Respectfully, W. C. THOMA, Vice-President."

Items of Interest about the Trade

—Announcement has been made that Mr. J. B. Greer is no longer connected with the Pittsburg Filter Manufacturing Company, of Pittsburg, Pa.

—It is interesting to know that brick is beginning to be extensively used for the construction of rural highways. The Pittsburg-Buffalo Company, of Pittsburg, Pa., is furnishing the brick for such a road at Waynesburg, Pa.

—Mr. Charles T. Silsby, formerly of Seneca Falls, N. Y., for many years treasurer of the Silsby Manufacturing Company and afterward president of the American Fire Engine Company, and who is well known in fire circles, is now president of the Dry-Sole Company, with offices at 99 Warren Street, New York City.

—The Central Foundry Company, 116 Nassau Street, New York City, recently received a letter from the Knickerbocker Construction Company, describing the installation of about seven miles of 4 to 10 inch universal pipe, part of which was under conditions which prohibited the use of any other kind of pipe. As this letter contains useful information it will be of value to all users of pipe, and can be had for the asking.

—In the article, "From Road Plows to Steam Rollers," on page 147 of our March issue, the name of the firm was given as the "Commercial Railway Equipment Co.," and should have been the "Continental Railway Equipment Co.," while the name of the manager was given as Geo. H. Howes, when it should have read Geo. H. Hewes. These corrections were made by the editor, but were not made by the printer. It is one of the mistakes which sometimes occur in the publishing business, and we take pleasure in correcting it.

—The directors of Warren Brothers Company, of Boston, have appointed George C. Warren, formerly vice-president and general manager, president of the company to fill the vacancy caused by the death of Frederick J. Warren; and have appointed Walter B. Warren, formerly assistant general manager, as general manager. The other officers of the company remain unchanged and are as follows: Hon. J. M. Head, vice-president and general counsel; Albert C. Warren, treasurer; Ralph L. Warren, secretary; Charles O. Warren, general superintendent.

—The Hydrex Felt and Engineering Co. has just commenced business in a special line at 120 Liberty Street, New York City. It deals exclusively with the subject of waterproofing, heretofore comparatively neglected. Now that nearly all cities are or soon will be concerned with burrowing under the earth or building above the earth, the necessity for giving attention to the new conditions surrounding subterranean constructions has become imperative. For this reason all those interested will find it to their advantage to investigate the new methods of waterproofing promoted by this company.

—THE MUNICIPAL JOURNAL is informed that the John Simmons Company has added another department to its already extensive business; viz., acetylene gas lighting. Many of the readers of this JOURNAL are familiar with this concern as one of the largest dealers in pipes and valves in the world. The point of especial interest in this connection is that particular attention will be given to the installation of town lighting plants, although the trade in small plants suited to the private house or public building will be pushed none the less vigorously. After a most careful investigation into the merits of the acetylene generator known as the "Victoria," as well as the validity of its patents this machine was selected, and the concern believes that it has the best thing on the market in this line, and, for this reason, has taken hold of the new field with the energy which is bound to win and which is characteristic of its other undertakings. The new department is located at 96 Center Street, New York. with Mr. W. A. Cochrane as manager.

Publications Received

—"Cementology," Vol. 1, No. 2, January, 1905, published by the Whitehall Portland Cement Company, Philadelphia, Chicago and Pittsburg, is one of the new monthly publications to reach the editor's desk. It has a circulation of ten thousand. In this number it deals with the subject of "What Constitutes a Perfect Mixer of Cement, Sand and Stone," and several other items of interest. It is an 8-page periodical, and promises to perform an excellent service for the company whose brand of cement it is expected to talk about.

—The International Sprinkler Company, 517 Arch St., Philadelphia, with branch offices in New York and Charlotte, N. C., has just issued a handsome 60-page catalogue, with illustrations and cover. It tells all about the sprinkler equipments installed by this company and its licensees, besides containing considerable information of value to fire commissioners, fire chiefs and others interested in the best methods of protection from loss by fire. The subject is dealt with in a scientific manner and the points discussed clearly show us that even the laymen can appreciate the great value attaching to the use of the International Sprinkler. Drescriptive catalogue, price list, etc., will be sent to any address upon application.

—Commissioners of health, health departments, sanitary engineers and aldermanic committees dealing with the question of sanitation, and others, will be interested in the 16-page catalogue, illustrated pamphlet recently issued by the Kensington Engine Works, Ltd., Francis Brothers, No. 245 N. Broad St., Philadelphia. This pamphlet shows something of the work of design and constructing disinfecting machinery for stationary quarantine stations, floating quarantine stations, hospital disinfecting plants and portable disinfecting plants as manufactured by this company. All those interested in this machinery will learn something to their advantage by corresponding with the Kensington Engine Works.

—"DeLaval Centrifugal Pumps" is the title of an attractive 48-page catalogue recently issued by the DeLaval Steam Turbine Company. It has a handsome cover, printed in two colors, while the letter press is well illustrated with half-tones and line cuts.

—The Hersey Mfg. Co., Boston, Mass., has a new water meter price-list and descriptive catalogue ready for distribution. Like all of its printed matter it is gotten up in the best style of the printer's art.

—In a neat 16-page pamphlet, with cover, printed in two colors and well illustrated, The International Fence and Fire Proofing Co., of Columbus, O., tells about the American concrete mixers which it makes.

—The Firestone Tire and Rubber Company, of Akron, O., has just published a beautiful 16-page brochure, tastefully illustrated and printed in sepia, telling about its victories at the World's Fair and of the excellence of its products.

—The 1905 catalogue of the Morris Machine Works, builders of centrifugal pumping machinery, stationary and marine engines, is out ready for distribution. It can be had by addressing the company at Baldwinsville, N. Y.

CONTRACT NEWS FOR THE MONTH

Including Paving, Sewerage, Water Supply, Lighting, Public Buildings, Sewage and Garbage Disposal, Fire Supplies, Contracts Awarded

N. B.—All news of proposed work sent us by city officials is incorporated in our Weekly Advance News Service and appears subsequently in this "Contract News for the Month" if the date of the reception of bids be sufficiently late to warrant placing the item here.

City officials and others are urged to send us all news of contemplated improvements for use in our Weekly Bulletins which are mailed to those interested.

PAVING, PAVING MATERIALS AND MACHINERY

Albany, N. Y.—Senate Judiciary Committee reported favorably on bill authorizing State to issue $50,000,000 of bonds for good roads.

Allegheny, Pa.—Recently voted to issue $420,000 bonds for street improvements and sewer construction, and $125,000 bonds for regrading and repaving streets.

Anderson, Ind.—Plans are being prepared for two miles of brick paving, to be laid this spring.

Augusta, Ga.—Contract for paving Jackson street will be let in May.

Baltimore, Md.—State will rush work on 159 miles of road construction. City passed order to widen Light street, and appropriated $750,000 for that purpose. May issue $2,000,000 instead of $5,000,000 bonds for street paving. May repave McCulloh street with smooth blocks.

Bloomdale, O.—Township Trustees will construct six and one-half miles of stone roads this summer.

Boston, Mass.—Will petition legislature for authority to issue $600,000 bonds for the widening of Chelsea street, Charlestown.

Bowling Green, O.—Broom County may build 8 miles of road this summer.

Brookhaven, Miss.—Will construct 16 square miles of pressed brick sidewalks this summer.

Canon City, Colo.—May want bids about April 17 for 196,000 square feet of sidewalks and 6,200 linear feet of cross walks.

Cedar Rapids, Iowa.—Will pave with repressed block brick on Second street and A and B avenues.

Chicago, Ill.—Will pave with asphalt on North Marshfield avenue, $29,500; West Twenty-second street, $64,000; West Sixty-second street, $34,000; Union avenue, $24,000; Thirty-fifth street, $26,500; South Hamilton avenue, $14,000, and Waller street, $16,500; with brick on West Sixty-fourth street, $15,000; and other paving will bring total up to $400,000.

Cincinnati, O.—City Engineer has submitted a list of 55 streets on which repair contracts expire this year, and 16 others not under repair contracts, and bids for this work may be asked.

Cleveland, O.—Will grade, curb and pave Doan, Bridgeview, Glazier, Barkwill, Louis, Aurundale, Elmwood, Stanton, Adrian, Huron streets, Margaret place, Brookfield and Huntington avenues. Will issue $531,000 bonds for paving 92 streets and $200,000 bonds to pay city's share of the expene of paving and sewering many others; also $152,000 special assessment bonds for paving 7 other streets.

Concord, N. H.—Governor has signed bill appropriating $125,000 annually for six years for improvements to State highways.

Corydon, Ind.—Thirty miles of gravel roads will be constructed this spring. G. C. Doolittle, Engineer.

Dallas, Tex.—County will sell another $100,000 of good roads bonds.

Danville, Ill.—Will gravel and pave Chandler street, estimated at $18,835.

Duboise, Pa.—May lay 20,000 square yards of pavement this year.

Duluth, Minn.—May construct 5 miles of new pavements this season.

Fall River, Mass.—Will want bids for 17,000 linear feet of curbing, 220,000 granite blocks and 30 catch basins.

Findlay, O.—Will pave Clinton street with vitrified block, estimated at $5,804.

Fremont, O.—Will want bids about June 1 for 29,000 square yards of brick pavement.

Greensboro, N. C.—Recently sold $75,000 street improvement bonds.

Iowa City, Ia.—May pave Iowa avenue; 21,470 yards, estimated at $45,000.

Jersey City, N. J.—Plank Road Commission of Essex and Hudson Counties has ordered plans and specifications prepared for the Plank Road, estimated at $1,000,000.

La Crosse, Wis.—It is reported that bids will be wanted April 18 for 11,206 linear feet of combination curb and gutter, 5,100 square feet of concrete driveway, 19,207 square yards of macadam and 5,130 cubic yards of grading.

Lansing, Mich.—Has completed plans and specifications for paving Grand avenue and Walnut street.

Little Rock, Ark.—Will pave Centre street with brick, estimated at $50,000.

Manchester, N. H.—May appropriate $49,000 for paving, etc.

Mankato, Minn.—Has ordered 30,000 square yards of brick paving on 2 streets.

Marion, Ind.—Will lay 2 miles of brick paving this summer.

Massillon, O.—Has prepared plans and specifications for paving about 2 miles of streets, estimated at $49,000.

Michigan City, Ind.—Will lay 33,700 yards of brick paving with cement curb.

Milwaukee, Wis.—May pave Wells street with asphalt; Mitchell and Clinton streets, Muskegon and Eleventh avenues with brick; and Clybourne and Galena streets with Kettle River sandstone.

Minneapolis, Minn.—Wants bids April 14 for 40,000 square yards of creosoted wood blocks. Petitions have been received for $1,000,000 of paving.

Mobile, Ala.—May improve Ann, Broad, Conception, Beauregard, Armitage, Canal and St. Joseph streets, and Spring Hill and Davis avenues.

New Orleans, La.—Has ordered asphalt paving on 33 streets, aggregating 14 miles and embracing 240,000 square yards of pavement and is estimated at $985,952. Work will begin before the last of April. May soon want bids for paving Atlanta street.

New York (Brooklyn), N. Y.—Flatbush Local Board has voted $120,000 for paving with asphalt on concrete base on Bedford avenue.

Paterson, N. J.—May want bids early in April for $159,000 of asphalt paving.

Pittsburg, Pa.—Separate and sealed proposals will be received at the office of the city controller until the 5th day of April, A. D. 1905, at 10 o'clock A. M., for grading, curbing and paving with asphalt on fourteen streets; for grading, paving and curbing with block stone on five streets; for grading, paving and laying of sidewalks with block stone on four streets. Edward M. Bigelow, Director Pub. Wks.

Portland, Ind.—Jay County will construct 12 miles of macadam roads this year.

Rockford, Ill.—Board of Local Improvements has ordered 4 miles of macadam paving.

Sacramento, Cal.—Senate has passed the bill providing for an appropriation of $25,000 for constructing a road from General Grant's Park to King's River Cañon.

Salt Lake City, Utah.—The estimated cost of paving Market street is $12,720 and for cement walks, $3,720.